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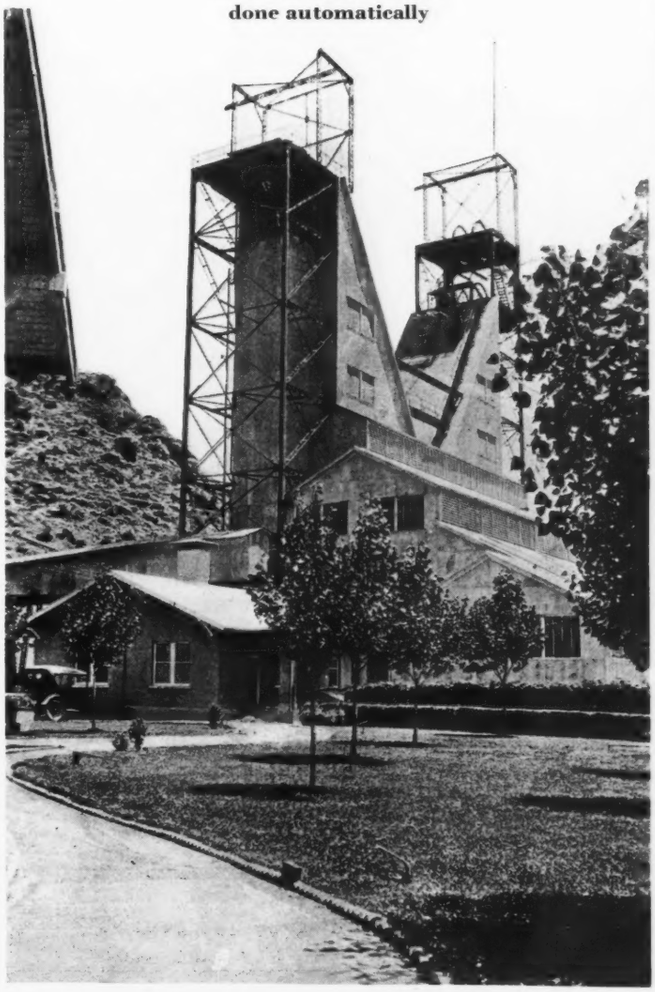

The Ajo Enterprise of the New Cornelia Copper Co.—IV
By A. W. Allen

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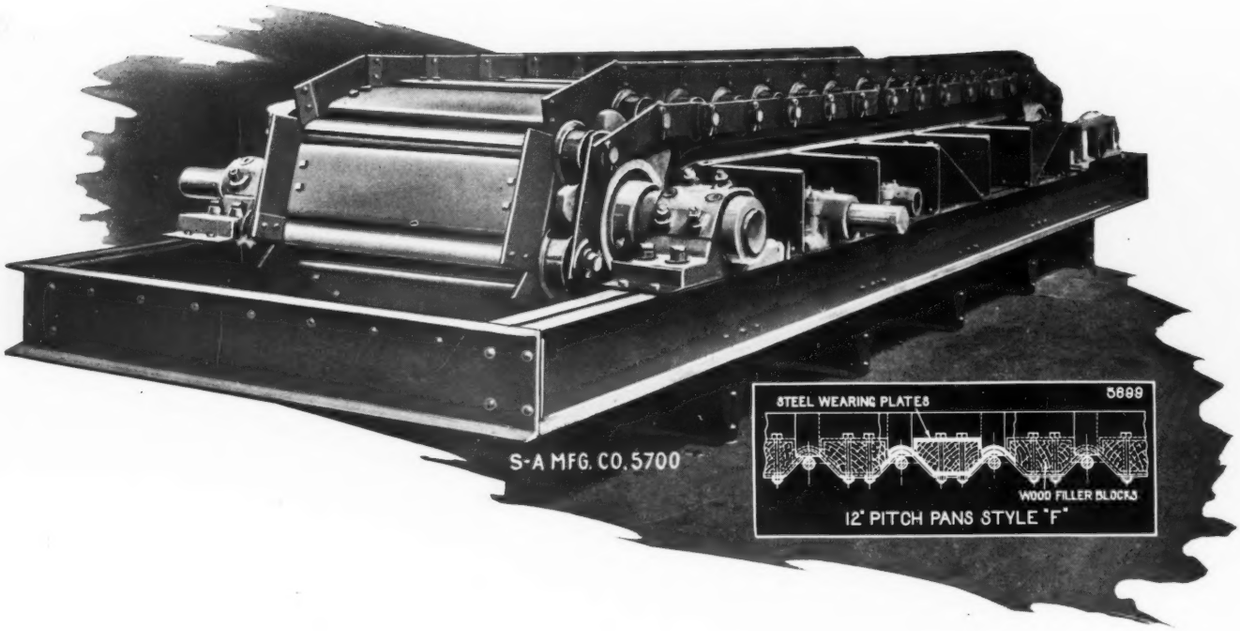
A WEEKLY JOURNAL REPRESENTING THE WORLD'S MINING AND METAL INDUSTRIES

July 29, 1922



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Volume 114 | New York, July 29, 1922 | *Number* 5

Copper or Aluminum for Overhead Power Cables

A LARGE-DIAMETER WIRE CABLE is needed in high-tension lines of 150,000 v. and over. Aluminum, being bulky, has been favored on this account, a steel-cable core being used to give sufficient structural strength. At first much trouble resulted because of slippage between the aluminum and the steel. It was found impossible to design or arrange a clamp that would grip both metals equally. This was eventually overcome by using double clamps, one for the steel core and one for the aluminum casing. Distances approximating 600 ft. between supports were then spanned successfully; and many electrical engineers considered that for the conveyance of high-tension current the aluminum conductor had come to stay. Had this prophecy been fulfilled there would have been a distinct diminution in the demand for copper. However, other drawbacks to the use of aluminum became apparent. The chief engineer of an important western power company states that aluminum is more easily cut and damaged by sharp sand than is copper; that, with large-diameter steel-centered aluminum cable, the softer metal creeps and bunches at various points along the line; that aluminum is more easily burned, and that the extensive contact between galvanized steel and the softer metal invites corrosion.

There never has been any doubt as to the suitability of copper as a conductor for current of moderate or low tensions; and for the sake of the copper industry we are glad to note that copper cable is coming into its own again as the most desirable conductor for high-tension lines. Recently 10,000,000 lb. of copper was used to fill an order for a power line in California. The cable was wound on 1,928 reels, each containing half a mile of conductor, and is to be used for one of the two highest-pressure overhead cables in the world—the Pit River transmission line of the Pacific Gas & Electric Co., which will convey electric power at 220,000 volts. To avoid excessive loss by what it known as corona discharge the cable chosen is of the rope-lay type. It is comprised of seven wires each of seven strands, the individual wires, forty-nine in number, being of about $\frac{1}{10}$-in. diameter.

Further utilization of hydro-electric power is inevitable, especially in the Western and Southern states. Copper is needed in enormous quantities for the construction of generating apparatus and distributing cables. At the thousand and one points of consumption an increasing demand arises for copper and brass utensils, instruments, appliances and fittings. The expansion of the electrical industry is an evidence of extending civilization, of an economy of natural resources. For the consummation of the ideal of industrial efficiency an increasing amount of copper will be needed, for which no reliable and equally satisfactory material is likely to be substituted.

The Theory of Isostasy

BULK FOR BULK, the mountains weigh less than the valleys: the continents less than the rocks which lie submerged by the seas. This is a scientific fact determined by careful instrumental measurements of specific gravity, in surveys conducted by different engineers independently, but especially by the United States Coast and Geodetic Survey. In a different and picturesque way, this general conclusion has been confirmed by Dr. H. S. Washington, of the Geophysical Laboratory at Washington, who assembled a vast number of recorded rock analyses, divided them according to geographical origin, and computed from their average specific gravity; and likewise arrived at the result that, speaking broadly, high areas are of less specific gravity than low areas.

It has been suggested from the above facts (though they by no means go far enough to demonstrate that conclusion) that along any radius of the earth the average specific gravity will be the same as along any other radius. But erosion is constantly wearing down mountains, carrying them into the sea, and thus disturbing such a perfect balance, if it exists. Therefore the theory has been presented that the continents are uplifted, to compensate for their wearing down by rains and rivers, so that the equilibrium as it apparently exists and is indicated by the data above referred to, is permanently maintained. Of course this implies some transfer or flow of material beneath the crust, to support at the base these continued elevations.

This principle of (theoretical) permanent equilibrium of weight between continents and oceans, between great mountain masses and great valley regions, has been called isostasy, which is Greek for equilibrium, which is Latin for balance. According, then, to the theory of isostasy, the oceans and the continents, the great mountains and the great valleys, are in perpetual balance, a balance which readjusts itself when its disturbance is threatened by the independently acting transfer of rock material from the highlands to the lowlands, from the continents to the oceans, through erosion and deposition.

Unfortunately for the plain sailing of this theory, based on the undoubted conditions first mentioned above, the array of collateral facts show that it is not so simple. Shore-line studies show great up and down movements, now sinking a coast beneath the sea, now elevating it high above it, and back again, all in geologically recent times, and far more rapidly than the wearing down of the land by erosion—indeed, evidently acting quite independently and without regard to the transfer of rock material from high regions to low areas by the processes of erosion. And geological studies show that this has also been the case in the past—that, as likely as not, great erosion has been followed by sinking of the land, great sedimentation in the ocean by elevation of the sea-bottom to become land.

Thus we have the basis for a fine dispute: on one hand, essentially, the geodesists; on the other hand, the geologists. Neither pretends to know much about the work of the other, but each is very sure of the reliability of its own observations, deeming them incontrovertible facts, to which any theory must agree. And indeed, there are no grounds for disputing the fundamental facts put forward by each of the contending parties.

Evidently then, other factors enter into the complete theory which shall explain all this, besides the theory of an automatically adjusting balancing, or isostasy. Indeed it is plain, not only that the adjustment machinery must be very slow and stiff, but that some other force in the meantime brings about both upheavals and subsidences of the crust.

A Water-Needle

STUDENTS of earth-sounding machines may be interested to know that a magnetic water-finder is reported to have been used with success in India by no less respectable an authority than the government of India. A report of the Department of Agriculture, at Bombay, in 1910 (Bulletin 38), by an assistant professor of physics at the Poona Agricultural College, details the experiment in the Deccan of Western India. This is a trap region, where the water is mainly confined to certain underground fissures, and a marked degree of success in following these water channels was reported. The instrument is described as follows:

"The instrument consists of a wooden case divided into two chambers. In the lower of the two there is a coil of wire wound on a bobbin; in the upper, at the center, is a pivot on which rests a light magnetic needle, which by its movements detects underground streams. There is also a graduated scale, on which the magnet moves, and by means of which the deflections of the needle are measured. On one side of the upper chamber there is a door which enables the magnet to be removed from the pivot at pleasure. With the instrument are provided a tripod stand and a table on which the instrument is to be placed while taking an observation. On the table there is a white line which is always to be directed toward the magnetic North, while using the instrument."

The principle of the instrument is described as follows:

"If a copper wire be held near a magnetic needle, and its two ends be connected to the two terminals of an electric battery, so that an electrical current flows in the wire, it will be found that the needle is deflected from normal position, and it will remain deflected so long as the current is traversing the copper wire. If, however, instead of directly holding the wire near the magnet, a closed metallic circuit be held near it, and a copper wire be placed near the circuit, it will be again found, on suddenly connecting the ends of the wire to the terminals of a battery, that the needle is deflected; the deflection is, however, only transient, and not permanent, as in the last case. Here, when the ends of the copper wire are suddenly connected to the terminals of the battery, the current flowing in the wires induces a transient current in the metallic circuit, which causes the deflections of the magnet; and as the current induced in the metallic circuit is only transient, the deflection of the needle is temporary. If, again, the intensity of the current flowing in the wire be suddenly varied, a transient current will be induced in the circuit, which will once more produce a temporary deflection of the magnetic needle. This principle is known in physics as the principle of electromagnetic induction.

"The same principle causes the deflections of the magnetic needle in the water-finder when it is fixed at a place below which a stream is flowing, with this difference, that here the inducing currents do not flow along a copper wire, but are generated in the underlying strata. These currents, which are known to be generated by a variety of causes, generally follow the course of a stream, that being the path of least resistence. They then induce currents in the water-finder much in the way in which the current flowing in the copper wire, in the above illustration, induces in the metallic circuit; and it is these induced currents that affect the magnetic needle, in the upper part of the chamber, which consequently is deflected from its position of rest. The greater the strength of the subterranean springs, the more rapidly and violently does the magnet oscillate. The whole efficiency of the instrument would seem to depend, in fact, on the preference of earth currents to follow the path of an underground stream."

The conclusions of the 1910 bulletin were confirmed in 1915 (Bulletin 72 of the Department of Agriculture, Bombay) by the principal of the Poona Agricultural College (Dr. Mann). He concludes,

"The position as a result of the work is therefore that in a country where at least 40 per cent of wells under normal circumstances are failures, even in selected sites, wherever the automatic water-finder has indicated water, and a careful test, including boring, has been made, water has been found. As a rule, the supply indicated has been within the depth of well sinking; in a few cases subartesian water has been found by boring, at a depth varying up to 126 ft.

"Only one criticism can be made of these results, I think, and that is that similar boring would under almost all circumstances reach a water supply of some sort. Other borings, in what were considered likely sites, do not justify this conclusion. These have only given 66 per cent of successes, as against complete success when the water-finder has been used and has indicated water."

The Articulate Subordinate

A COMPANY report can be made to serve as a valuable source of metallurgic information, or it may fail to give any indication as to the technical progress of the work during the period under review. One method of camouflaging quantitative results dealing with the treatment of a gold-silver ore is to omit all mention of weight of metal in ore or residue, referring only to its "value" in dollars. This practice is an unfortunate sequel to the heritage of a chaotic system of weights and measures. Comparison with results elsewhere is impracticable. The interested engineer struggles to decipher the data, only to find that he is stopped at every turn by an aggravating lack of definite quantitative information. He finally gives up the quest, which usually is what the compiler of the "information" desires.

It is gratifying to note, however, that no blanket indictment against company reports can be made with justification, although it is obvious that the shortcomings of the many serve to accentuate the virtues of the few. In this connection it is a pleasure to be able to draw attention to the metallurgical information contained in the annual report of the Tonopah Belmont Development Co. In this is given all the essential data needed to gage the efficiency with which a gold-silver ore is being treated. The weights of both precious metals in the ore are given in ounces and decimals of an ounce; the percentage extraction of each is quoted separately; there is no reticence about actual recovery. The percentage yield, on the basis of combined valuation of both gold and silver in the ore and in the tailing, is quoted for the benefit of those who are interested in the financial side of the operation.

Satisfactory information on metallurgic results is usually found in those company reports in which subordinate officials in charge of one of the two more important phases of the work—mining and milling—are permitted to become articulate in the yearly statement to the stockholders. In the present instance adequate space is given to verbatim extracts from the report of the superintendent of milling at the Tonopah Belmont company's plant. The result is an absence of camouflage and the presentation of valuable quantitative data, all of which serve to reflect credit on the general manager, Mr. Frederick Bradshaw.

A Word for Lead

DURING the recent period of tribulation for the producers of copper and zinc, the lead mining companies have, generally—and figuratively—speaking, gone ahead sawing wood. Fortunately for them no huge surplus of metal was accumulated during the war to be disposed of afterward during a period of decreased consumption. One fundamental difference between the situation of lead mining and that of the other metal industries is that, although production was accelerated, the capacity for production was not increased materially. New low-grade copper mines have been opened, new treatment plants have been built and old ones have been improved and enlarged. In the case of zinc the increased capacity for production arises in a large measure from the improved metallurgy that has made available for exploitation large deposits of zinc ore that hitherto have been known but ignored. The capacity of zinc reduction plants also has been increased. With respect to lead the emergency of the War was met largely by stimulating the production from the operating mines and by working the existing blast furnace plants at maximum capacity. Few new mines or fields were developed or discovered.

These facts add significance to the recent action of the St. Joseph Lead Co., in taking an option on the famous old Mine La Motte property, comprising 37,614 acres of land in the disseminated-lead area of Madison and St. Francois counties, in Missouri. The mine, now owned by the Missouri Metal Corporation, is credited with the production of more than $20,000,000 worth of lead from shafts averaging only 125 ft. in depth. History records that lead ore was first produced in 1723 since which time the property has had a checkered career, several fortunes having been made and lost in different manipulations. The mine is equipped with a 1,000-ton concentrator with a flotation unit of 350-ton capacity and a large Diesel-engine power plant. Incidentally some copper and nickel-cobalt ore has been mined but attempts to smelt it profitably have always failed. The mine has been idle since 1919 when all operations were suspended.

Six diamond drills will be started by the St. Joe company in an effort to determine just what quantity and grade of material can be counted upon. That there are millions of tons of low-grade lead-bearing carbonate, much of which can be mined by steam shovels, is not to be doubted. Just what price would have to be obtained for lead in order to make it possible to exploit the deposits profitably is a complicated engineering problem. We surmise that the St. Joe company plans to invest a reasonable sum of money in attempting a solution of it.

Broad or Deep

CHESTER H. ROWELL, writing in western papers, discusses the question of the field for engineers in public life, with considerable trenchancy:

"Someone has started the slogan: 'We have a lawyers' government and an engineers' country.' From which the moral is drawn that we ought to substitute engineers for lawyers as our governing class.

"Not yet! The engineering mind has, to be sure, the advantage over the legal mind, in that it deals with facts rather than with fictions, and with things rather than with words. Also, it is the business of the engineer to find out and do, while it is the purpose of the lawyer to advocate and win. Decidedly the engineering mind is better for the purpose.

"But more is needed than mind. There must also be knowledge. The lawyer who knows nothing but law is not equipped to participate in government, and rarely does so. Lawyers achieve leadership mostly by the things they know outside of the law. When engineers know as much about things not engineering as lawyers do about things not law, then they can compete on terms of equality for preference to the ruling class.

"Some engineers do so qualify. They are the most useful, even as engineers, and are the only ones that are of much use outside of engineering. But they are still too scarce. The engineer has the handicap of being an educated man, which the lawyer frequently is not. But of all educations, that of the engineer is the most exclusive. He begins to specialize earlier and specializes closer than anyone else. If he learns anything important besides engineering in college, it is by his own initiative, and if he extends his intellectual interests widely afterward, it is by innate versatility. Both instances are too rare.

"We do need the engineering mind in government, more than we need any other thing. But first we need broader-trained engineers to exercise it, whose chief qualification shall be the things they know outside of engineering."

There is a great deal of truth in the above. Engineers are as a class deep—and very narrow. They do not cut a wide swath: they have entrenched themselves in a deep groove. They are not interested or well informed outside of their specialty. Most mining engineers are not even interested in all the phases of mining. One is a metallurgist, and disdains geology, marketing problems and the national and international phases of his business: another is an operating man, who boasts that he has not looked at any mining paper for a year (we have specific cases in mind) and plumes himself on his narrowness. Mining engineers should seek diversification in their periods of leisure, broader culture, an intelligent interest in the affairs of the world in general.

Last winter a well known United States Senator and the Chairman of the Committee on Mines and Mining of the House of Representatives had arranged to come to New York and discuss the question of the desirability of a Department of Mines. The meeting was called off because New York mining engineers were found to be not interested enough to take the subway and attend. Certainly a bricklayerish outlook on life. What wonder if engineers are so often helpless unless someone hires them and tells them what to do: and that that someone is rarely an engineer?

The Alaska Juneau Enterprise

By T. A. Rickard

FOR decades the Alaska Treadwell Mining Company held the record for low cost, the lowest figure being made in the fiscal year ending May 31, 1900. when 557,960 tons of ore was treated at an average cost of 86 cents, and for a yield of $2.07, per ton. The president of the Treadwell company is Mr. F. W. Bradley. It was he who while a youngster, in 1887 gained distinction by his work as superintendent of the Spanish mine, in Nevada county, California, when he won a 50% profit on a gold ore averaging $1.15 per ton. To be exact, his mining cost was 37 cents and his milling cost 23 cents, so that the total operating cost was 60 cents. He had a soft ore to treat and he used Chinese labor, but the results were remarkable and attracted wide attention. Now, as president of the Alaska Juneau Gold Mining Company, he is engaged, on a much bigger scale, in living up to that early reputation. The Juneau mine is separated from the Treadwell by Gastineau Strait.

From 1880 to 1897, the Juneau mine was worked by its locators, who sold to the incorporators of the Alaska Juneau Gold Mining Co. in 1897. In 1910 Mr. Bradley made a contract with the company to drive a long adit and to erect a mill at sea-level. In 1915 the scope of the company's operations was expanded. This expansion was prompted by the example of the Alaska Treadwell and by the promising character of the work being done by the Alaska Gold Mines Company. The Treadwell, up to end of the year 1914, had produced 14,778,074 tons of ore, yielding $2.46 per ton, from which dividends amounting to $14,885,000 had been distributed. In 1912 the Alaska Gold Mines Company was organized by an influential group, including Hayden, Stone & Co. as brokers and Mr. D. C. Jackling as engineer, to exploit the Gastineau, or Perseverance, mine, which is on the same belt or lode as the Juneau; indeed, the so-called gold belt at Juneau consists of a lenticular orebody, four miles long and 1100 feet in maximum width, the northern end of which is covered by the Ebner mine, the southern end by the Gastineau, and the central or major portion, by the Juneau. The Gastineau was to erect a mill of a capacity not less than 10,000 tons per day, and a profit of 75 cents was expected from ore assaying $1.50 per ton. The Juneau was to produce daily 8000 tons of selected ore, on which a profit of 50 cents per ton was to be made. The Ebner enterprise was yet in course of incubation, but this group of three mines was expected to produce five million tons per annum; in short, Juneau was to loom large on the map. But the promise of a great industrial development was not fulfilled, and five years later an acknowledgment of failure had to be made. The sampling of the Ebner did not justify exploitation on a large scale. The Gastineau produced 2,240,346 tons in 1917; this ore assayed $1.103 per ton, and yielded 89.70 cents at a total cost of 77.02 cents. In 1920 the output was 2,133,458 tons, assaying 88 cents per ton and yielding 70 cents, which was recovered at a cost of 83 cents—that is, at a loss of 13 cents per ton. The trouble with the Gastineau enterprise was that the mine did not contain the grade of ore estimated; the yield declined to half of the $1.50 anticipated. However, the Alaska Gold technicians did excellent work in the mill; they applied the practice of copper-concentrating mills to their low-grade gold ore, using rolls and tables in lieu of stamps and amalgamating plates; they collected the gold in concentrates: a galena concentrate and a pyritic concentrate.

Meanwhile the Juneau had troubles, but of a different character. A mill having an estimated capacity of 8000 tons per day was completed early in 1917, but its maximum capacity during any one month in that year was only 3833 tons. The principal factor in this failure was the use of ball-mills and the attempt to reduce the ore in them from 3½ inches to 8 mesh in one operation. For this fiasco Mr. Bradley is not to blame, because he urged further experimental work in the pilot-mill, of 50 stamps. The decision to erect the big mill, and to hurry the erection of it, was taken by the directors under the leadership of Messrs. M. L. Requa and J. H. Mackenzie during Mr. Bradley's absence, owing to illness, at Honolulu.

During 1921 the net loss on operations was $168,731: up to the end of that year the total expenditure on property and plant had been $14,938,759, of which $1,965,322 was on mine development, and $3,333,592 on construction and equipment. In 1921 the total operating cost was 74.61 cents on 1,613,600 tons, an average of 134,466 tons per month, as against the 200,000 tons that the mill was expected to treat. The success of the enterprise depends upon the treatment of a tonnage equal to the full capacity of the mill, for only then is the cost low enough to leave a healthy margin of profit. In 1921 the yield was 64.16 cents per ton, of which 49.40 cents was in bullion and 14.76 cents in concentrates. Since then the mill has been 'tuned up' gradually, with the result that in June 207,200 tons was treated. The scheme of reduction includes the crushing of the run-of-mine and the separation of the waste, the slate and gabbro associated with the gold-bearing quartz being removed first on 12-inch grizzleys. At a later stage, after re-crushing and washing, more waste is removed on a sorting-belt by hand. Thus the 207,200 tons trammed from the mine in June was reduced to 103,400 tons, or almost exactly one half, before the fine-milling began. The mining and tramming cost was 17 cents per ton, the milling cost, 22 cents, and the general cost was 2 cents more; making a total operating cost of 41 cents per ton of ore trammed from mine to mill. As against this the yield was $112,000 in gold, or 54 cents per ton, and $6000 in silver and lead, or 2.89 cents more per ton, making a total yield of 56.89 cents per ton. Thus the operating profit was $33,000. From this must be deducted $8,500 for expenditures on capital account and $17,000 for San Francisco expenditures, which include taxes, interest, offices, etc. The total expenditure amounted to $110,500, leaving a profit of $7500. The result is encouraging, but not conclusive, for $7500 per month on a bonded indebtedness of $2,304,000—not to mention the common stock—would represent barely 4% per annum. Further improvement is assured, but as it is, the technical achievement is astonishing; to mine and mill a hard ore at a cost of 41 cents per ton! Even the small operating profit—15 cents per ton—is a performance in which the mining profession can take pride.

DISCUSSION

Revision of the Mining Law

Mr. Winchell and the Prospector

THE EDITOR:

Sir—According to your issue of June 24, 1922, at a recent hearing before the Committee of Mines and Mining at Washington, D. C., Horace V. Winchell made the statement that the mining industry of the great Northwest is languishing as far as developing and opening up new mines is concerned, and also that the prospector has run all over the country and cannot find anything more.

Recently a discovery was made in the old camp of Randsburg, Cal., close to the main road—an outcrop of silver-gold ore in plain view, and walked over by thousands of prospectors and miners.

This has produced, I am informed, over $2,000,000 within the last year and a half or so, and is an illustration of how rich mineral-bearing outcrops containing millions may be overlooked or passed up.

Mr. Winchell says we are justified in assuming that practically all discoveries have been made and that the prospector's day is over except as to Alaska, and that he knows of perhaps twenty exploration companies that have raked this country from Alaska to the Rio Grande looking for more mining (I suppose he means mining prospects of merit that need development), and they have failed to find anything. Perhaps they were like the Canadian Exploration Co., that blossomed into existence a decade or so ago, backed by New York capital, and examined over 1,500 prospects and never took hold of one to develop or work. Quite a few of those prospects have since made dividend-paying mines.

No, the day of the keen, observing, bona-fide prospector that understands formation, action, and intrusion is not yet over. He will still be a useful man in the mining industry in the distant future.

Mr. Winchell cites an instance of prospectors relocating and dummying ground for twenty years (presumably as a means to an end) and not being in a position financially to develop and bring to the producing stage, but he does not cite any instance of where capital held and dummied ground (as a means to an end) for a number of years, though being in a position financially to develop and not leave the wealth lying dormant.

Mr. Winchell can throw cold water on the prospector if that course suits him, but the mining fraternity owes the prospector much. Thousands of people today living in luxury and comfort owe much directly and indirectly to the prospector. Mr. Winchell says the prospector's knowledge, as a general rule, is not sufficient to justify his taking charge of a prospect and spending other people's money on it in the most intelligent manner to get results. In this I heartily agree with him, but I would agree still more heartily if he had bunched in a vast majority of mining engineers, in this respect, with the prospector.

Failure to understand the possibilities of a prospect and lack of sufficient technical ability to develop it successfully has possibly been the greatest drawback mining has had in the past, and will continue to be in the future unless remedied.

Numerous mines are lost in the getting by men incompetent to use the dollar to the best advantage in developing a mining prospect to get results. We can see silent monuments to wasted thousands of those failures in the shape of gallows frames, poppet heads, mills, and other abandoned equipment in the mining countries all over the world, from southern New Zealand to Alaska, if we look around, and no doubt payable ore remains to be developed where many of those monuments stand.

Personally, I have seen millions of dollars spent on prospects that did not justify the expenditure of one dollar as a record fee in the first place. I think a timely article from a man of the T. A. Rickard type on this subject, setting forth his views and advancing some suggestions *re* the expenditure of money in developing mining prospects in the future would not be out of place at this time.

In regard to the revision of the mining law, I think that if the apex law was abolished and a larger claim given to prospectors under laws that would enable them to take up most of the ground on the underlay side of the lead or vein, any other little defects could easily be remedied, but by all means we should adhere to a discovery, as it is the best check we have against the wholesale occupation of mineral lands by rich individuals or corporations.

In conclusion, I will say that it will be a sorry day for this generation and the mining industry if the time ever comes when there will be no incentive for a man to become a prospector and go out and discover something.

Long live the prospector!

Wickenburg, Ariz. MICHAEL MERRICK.

Murder Free to Voters

THE EDITOR:

Sir—I have read the editorial, "Murder Free to Voters" on p. 47 of your July 8 issue and commend it highly. Living as I do close to the district in which the massacre occurred, I have good reason to believe that the real facts in the case were not all made public and that the atrocities committed were much worse than the general public was led to believe. In the meantime nothing of any consequence has been done in the matter and probably never will be. This was a case of *"schrecklichkeit"* with a vengeance, the main purpose being, as stated by union men in this vicinity, to "put the fear of God in the hearts of the scab workers." Evidently this purpose has been accomplished to their entire satisfaction. There is great rejoicing among them throughout the land for having so well performed the job.

The public is prone to pity the poor Armenians who were subjected to no worse treatment than these men who were trying to earn an honest living by daily labor, and millions of dollars are sent them annually as a balm for the sufferings which they are supposed to have undergone, yet in our "enlightened" Illinois a man who does not carry a so-called union card may be tortured and killed without fear of punishment and apparently receives but little sympathy.

If the *Engineering and Mining Journal-Press* and all other papers who still believe in the rights of individuals in the United States would write more such articles as yours and write them oftener, I believe it might have some effect. However, the case looks pretty hopeless as matters now stand. W. C. BOHN.

Rosiclare, Ill.

The Denison Bill

THE EDITOR:

Sir—I agree with the editorial in your issue of July 1 on "The Denison Bill," but I hope you will see fit to support an amendment, proposed I believe by Mr. Arentz, of Nevada. Anyway, it would exempt from the provisions of the bill securities which have been approved by the Blue Sky Commissioner of the state of origin.

In other words, if a company in California complied with the Blue Sky law of that state, it should be allowed the use of the mails for the sale of its securities in other states. Certainly, the approval of the Blue Sky Commissioner of the State of California should overcome the presumption of fraud, which the Denison Bill attaches to all securities offered for sale. The approval of the state authorities should be as readily accepted as that of the New York Stock Exchange, or other stock exchanges, upon which securities listed are not subject to Blue Sky laws. MAURICE D. LEEHEY.

Seattle, Wash.

The Denison Law Applied

THE EDITOR:

Sir—In your issue of July 1, 1922, your editorial headed "The Denison Bill" was carefully read by me, and after due consideration I cannot resist expressing my opinion of same. I am not an experienced writer, but I have recently had some serious experience in raising money for the — Mines Co., located in Lemhi County, Idaho, and as we have successfully accomplished what we went after, I feel somewhat competent to discuss the proposed Denison Bill. We sold about $600,000 worth of stock at a promotion cost of less than 3 per cent, and we are today operating our mill and mine and the results we are obtaining are very much better than we have promised the buyers of our stock, much better than any statement made while financing the company. We have very much more ore in sight, the quality of our ore is better than promised, our mill tonnage is greater and our mill extraction is very much better. As soon as we can get our labor up to full quota another dividend-paying copper mine will be added to the list.

It is because of this accomplishment and experience that I feel competent to discuss the proposed bill. I shall state that if the Dension Bill had been a law while we were financing our property, we could not have succeeded, it would have been a failure. Under the Denison Bill I could not have solicited my friends and acquaintances through the mail unless we had taken out a license in about forty states, which would have cost the company about $40,000 and this would have been spent without the least assurance of ever getting a dollar through same. No ordinary company, while in a stage of formation, could stand such an outlay and delay in getting these various licenses. We had licenses in two states, namely Illinois and Michigan, but have sold stock in many states through the mail by personal letters to acquaintances and friends, and not through any advertising campaign or circulation of literature. In one instance I sold $30,000 worth of stock by writing one letter to a friend of mine in California. You can readily see how the Denison Bill would have prevented this and the result would have been another mining failure and a lot of innocent people would have lost their money because of the extreme ignorance on the subject by most of our law-makers.

I can furthermore state, that, in my humble opinion, most, if not all, of the so-called state Blue Sky laws are no good; they do not accomplish what they are intended to, but they do prevent honest, clean and legitimate mining promotion. I believe in the course of time that they will destroy the mining industry, and unless changed, some day the people will wake up and find mining almost dead—no more metal. This may sound pessimistic, but I am speaking from experience and I believe I know what I am talking about.

I do believe, however, that the public should be protected as much as possible against crooked and unscrupulous promoters, but this should be done without too great a sacrifice to honest and legitimate mining enterprises. It should not be very difficult to write such a law, a law that would protect the public far better than any of the present Blue Sky laws, and at the same time give encouragement to honest mining development, instead of stifling it. One thing is sure, that with the present Blue Sky laws and especially with the Denison Bill enacted, I for one would never try again to develop a mine through stock subscription, and we could never have developed the — Mines if these various paternal Blue Sky laws and Denison Bill had been active at the time we first began raising money. A. W. NIEMAN.

Chicago, Ill.

Booms that Hurt

THE EDITOR:

Sir—I wish to call your attention to an editorial in the issue of July 1, under the caption "Booms That Hurt." Knowing, as I do, the long-standing reputation for fairness enjoyed by your publication, I feel that, in the article referred to, an unintentional injustice has been done. The mistake is not one of commission but of omission. The Katherine district is referred to as "dead"; the Oatman "boom" as waning. On the surface both of these statements are true, but evidently the *Journal-Press* has not been fully informed.

The Katherine district has suffered a setback due to pending litigation involving title to an important part of the Katherine holdings. This, together with an unusually hot summer season, has reacted upon the development of the district as a whole, to its disadvantage. With the final judgment of the court on the Winchester-Katherine suit, it is quite certain that work will be resumed. The camp is therefore not "dead" but in a state of suspended animation.

The results given out on the Oatman United were not based upon the results of a single drill hole, but on a number of drill holes so placed that each confirmed the others. Underground development has now borne out the drilling. Encouraging showings have also been made in other properties now undergoing development, among which can be mentioned the Telluride, United American, and Oatman Combination.

It is true that the newspaper man, the promoter, and the broker have been and are in evidence, but all new and promising camps inevitably suffer from this evil. It is significant that the money that has been raised is going into actual development in the camp, and that much of it was supplied by the men working in the mines there, whose faith in the future of the camp is thus shown.

The impression left in the minds of those reading the editorial referred to is distinctly unfavorable to two promising mining districts. It makes it harder for those having promising prospects to secure the money necessary for development. Such development must of necessity, and as a rule, depend upon the contributions of those inclined to speculate. There are relatively few who are willing to individually shoulder the burden. The smaller contributions of many are needed, and, if not secured, mining must continue to languish, and a worthy industry, basic in character, be left unsupported. To accomplish this it is necessary to draw public attention to favorable mining localities, and to set forth their merits and the opportunities offered.

Those engaged in legitimate attempts to develop promising mining properties need all the support that can justly be accorded by a publication of the importance and standing of the *Journal-Press*, and if not that, at least a continuance of its traditional fairness.

In this connection I wish to state that I am not engaged in promoting any mining property anywhere; am not personally interested, other than in a consulting capacity, in any mining property or other enterprise in either of the two camps referred to above. I am, however, in a position to know that the information given herein is true. EDWARD W. BROOKS.

Los Angeles, Cal.

The Versatile Mining Engineer

THE EDITOR:

Sir—My perusal of the July 8 issue of the *Journal-Press* left me with mingled feelings of pride and despair; pride because of the implication that a mining engineer has (or should have) such a wide knowledge of things in general, and despair because of the difficulty involved in becoming familiar with so many subjects. I refer to the able editorial on p. 46, entitled "The Get-Together Spirit." Here it is stated that the mining engineer "is or should be interested in all subjects that affect human progress . . . he should welcome an opportunity to hear the opinions and experiences of others on subjects such as electric telephony, serum therapy, a non-oxidizable steel, reading by sound, the moving picture in industry," and so on down a long list of subjects.

Turning then to Mr. George J. Young's interesting article on the "Mining Curriculum at the Massachusetts Institute of Technology," I found in the last paragraph the following: "The fundamental criticism which might be given to Technology as a whole is the absence of definite contrasts in the educational scheme. It points strongly in one way. It is true that Technology counters this by encouraging athletics and other subordinate activities, but are these a satisfactory solution? Why should technical students not know something of music and art? Would not a series of concerts with accessory explanations of motives and technic and a series of lectures on various aspects of art be an entirely practical way of securing contrasts?"

There can be no question of the value to the mining engineer of a wide general knowledge. In order to make the proper use of this wisdom, however, and to afford the contract desired by Mr. Young, it occurs to me that our engineering colleges might do well to introduce courses into their curricula on one or all of the following subjects: human engineering; the cultivation and use of tact and diplomacy; proper English expression, both written and spoken. The average embryo engineer is woefully lacking in at least two out of the three. EDWIN HIGGINS.

San Francisco, Cal.

The Reader Comments

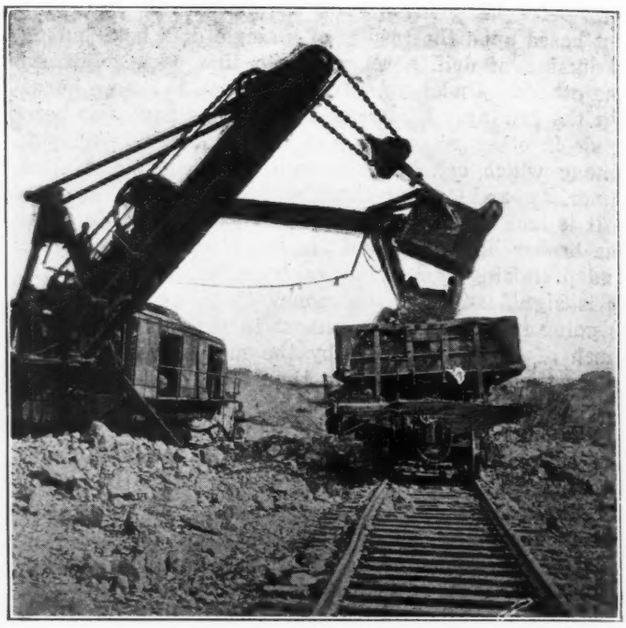
THE EDITOR:

Sir—I think my work should be *examining mines and turning them down;* I see so few that I think could be developed and operated at a profit that as a promotor I certainly am a failure. As a "de-motor" of mines I should be a success. Still I am almost invariably right. The mines I reject never develop when operated and the ones I considered real mines made good; so on the whole I am forced to take a rather gloomy view of the business and feel like an out-and-out knocker, going around the country throwing cold water on contemplated mining ventures and making my living by blasting other peoples' hopes and "knocking" mining property. Have about forty old mines and prospects up to mining companies. Six months will decide the fate of these properties. They will all be rejected or accepted by that time. Then I am going to quit the business and become "a detached onlooker." Do not expect to investigate mining geology as an exact science. It is only approximately so, but geology in all its branches is intensely interesting to me. Pure science appeals to me. Don't like the bother of handling money or men.

I like the *Journal-Press* very much. Enjoy reading T. A.'s articles. He must have studied Trench's "The Study of Words." "To study the words of a language is to study the history of the people who speak it," so says Trench. Whoever wrote "The Ethics of Mining" has my respect and admiration. The only thing I miss in the *Journal-Press* is the picture at the top of the page over "Discussion." I used to enjoy looking at it, studying the facial expression of the group of men around the table, imagining what they were discussing, how to treat the ore, how to operate the mine, whether to quit or make the payment, or how to finance the project. The artist must have sketched them from life, or else he had been through the mill himself and sketched from memory. At any rate, the gentlemen so earnestly engaged in discussion had packed their gestures in their hand-bags for emergency use when leaving for that meeting, and judging from the picture the emergency had arisen. EARNEST READER.

San Francisco, Cal.

Filling the dipper of an Osgood shovel



Emptying the dipper of an Osgood shovel

The Ajo Enterprise of the New Cornelia Copper Co.—IV

Ore Now Being Taken from Last of Three Hills—Gyratories and Symons Disk Machines Used for Crushing—Concrete Leaching Vats of Special Design Used, Features of Process Being Upward Submergence, Upward Percolation, and High Rate of Flow

By A. W. Allen
Assistant Editor, *Engineering and Mining Journal-Press*

THE METHODS adopted to mine the three hills at Ajo, the last of which is now being removed, may be considered under three headings:

1.—*Blasting by Explosive Placed in Adits Parallel to the Face.* This method is needed for high benches, in connection with which it was found impracticable to adopt the standard bench height of 30 ft. or so. The adits, comparatively small in cross section, are enlarged at intervals to form chambers to contain the charge of explosive, which is held in place by means of bags of tailing and by broken rock. The charges are fired simultaneously by electricity from the main circuit. Ingersoll-Rand Jackhamers are used in the driving of the adits and crosscuts, the broken rock being removed to the bench by wheelbarrow.

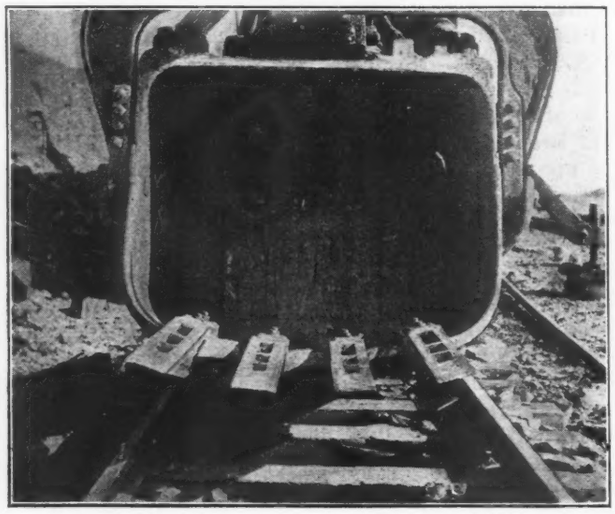


Fig. 1. Dipper fitted with Ekman self-sharpening teeth

2.—*Blasting by Explosive Placed in Drill Holes.* The method is standard practice, being used for benches about 30 ft. high. The holes are made with Type 24, Ingersoll-Rand rock drills, fifteen changes of steel—3½ in. to 1¾ in. diameter—being necessary. When the hole has been made to the required depth, one stick of 40 per cent "powder," with 2 or 3 ft. of tamping, is used to open the ground. The cavity is then blown clear by introducing a ¾-in. pipe in the drill hole, using compressed air at 80 lb. A second clearing charge of three or four sticks is then used, followed by a third charge of twenty to thirty sticks. The size of the chamber is gaged by the sound of the explosion. The final firing of the charge is done by the aid of an electric hand battery.

3.—*Blockholing of Boulders.* Pieces of rock that are too large for the steam shovel to handle are drilled with a Jackhamer and blasted in the ordinary way, but without the use of caps. Hercules "powder" is used in adits and crosscuts; Trojan "powder," elsewhere; 40 per cent is the standard.

Compressed air is supplied by one No. WH-4 Sullivan machine, motor-connected. A duplicate, of the same type and size, is held in reserve.

The loading equipment consists of one No. 29 Osgood steam shovel on tractor wheels, used for ditching and

cleaning, and four No. 105 machines of the same make. The fuel oil for the boilers is brought to the vicinity of the shovel in standard locomotove fuel tanks.

The shovels are equipped with two-piece manganese-steel dippers and the self-sharpening tooth invented and patented[1] by Fred Ekman, the superintendent of the mine. Fig. 1 shows a dipper with a new set of such teeth, which have the usual wedge point and shanks. On the faces, however, depressions are left during casting, the sides of which are of progressively increasing pitch, as considered from the point of the wedge. These depressions are staggered, the sub-teeth on the one face being opposite the depressions on the other. These sub-teeth do not extend to the edges. As the main wedge wears, the sub-teeth appear, thus providing a continuous cutting edge. The Ekman teeth are reversed periodically, so as to distribute the wear evenly on both sides. They are manufactured by the Taylor Wharton Iron & Steel Co., of High Bridge, N. J., to which the patent was assigned by Mr. Ekman.

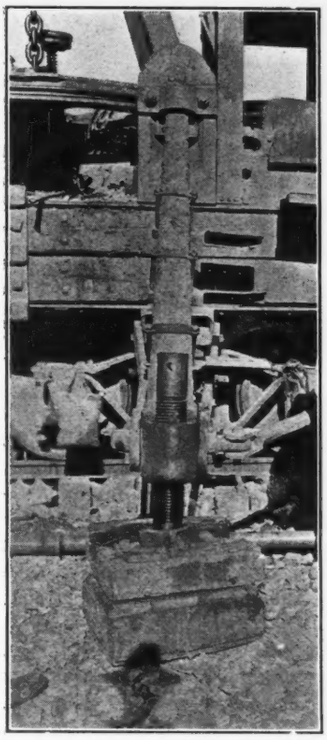


Fig. 2. Steps to operating platform of shovel

Several improvements and modifications have been made to the shovel in use at Ajo. The steps leading onto the operating platform (Fig. 2) will be recognized as more of a necessity than a refinement when they have once been used. Other features that invite attention include provision for the easy removal of the swing sheave, the plates to take the wear on the lip of the dipper, and the baffles to protect the ears. Dipper teeth are checked frequently. If their loss is undetected before they reach the Symons disk-crusher plant they are likely to cause much damage.

The ore as delivered by the steam shovels is transported to the mill in 20-cu.yd. automatic air-dump cars, of Kilbourne & Jacobs design and manufacture, and holding about forty tons apiece (see Fig. 3). The doors of these cars proved too light for the heavy duty required; they are now being reinforced with steel stiffening plates, $\frac{3}{8}$ and $\frac{1}{4}$ in., riveted top and bottom. Six cars of ore constitute a train, which is hauled by a Class 060-S 134 locomotive, weighing, with tender, about 100 tons and of American Locomotive make. The track is of standard gage. The total equipment consists of five locomotives and fifty-two cars, for handling 5,000 tons per day. En route the ore is sprayed with water (Fig. 4), to lessen subsequent dusting.

The coarse-crushing plant (Fig. 5) consists of one No. 24 gyratory crusher and four No. 8 machines of the same type, all manufactured by the Allis-Chalmers company. The final product, about 4-in. size, is carried by two 36-in. belt conveyors, with magnetic head pulleys, to a 10,000-ton, flat-bottomed steel bin (Fig. 6), from which the ore is distributed by five feeders to five 20-in. belt conveyors. These travel to the fine-crushing plant (Fig. 7), the ore being distributed among five primary, 48-in., vertical-shaft, Symons disk crushers. The product from each of these is raised by belt-and-bucket elevator and passed over a grizzly. The total oversize goes to ten more Symons machines (one bank shown in Fig. 8) of the same size and type as

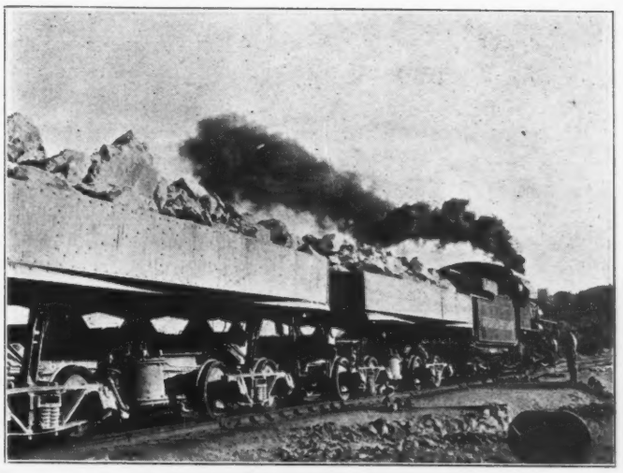


Fig. 3. Taking the ore to the plant

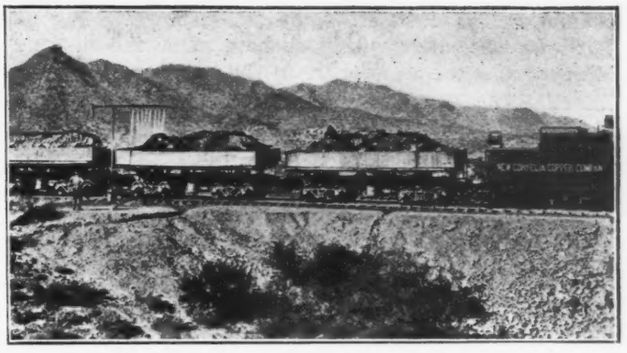


Fig. 4. Spraying the ore

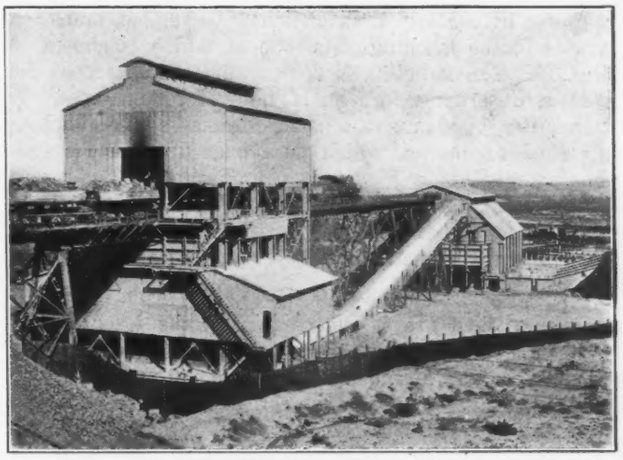


Fig. 5. The coarse-crushing plant

[1]U. S. Patent No. 1,333,394; March 9, 1920.

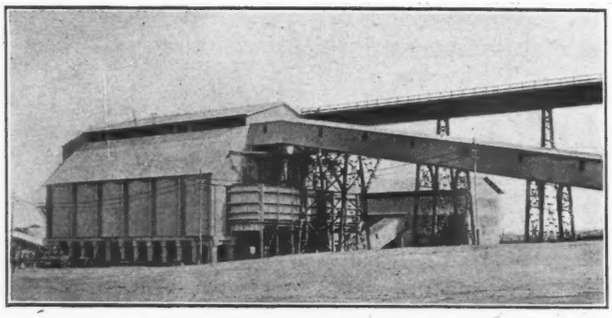


Fig. 6. 10,000-ton steel bin

before described. All these crushers are direct-connected to 75-hp. motors by unusually long shafting. This allows the motors to be housed in a separate part of the building, and away from the dust. Trouble from dust has been successfully overcome at Ajo, however. The foundations for the Symons crushers are tied together in such a way that a tunnel is left along the center line of the building; this serves to house a belt conveyor. Entrances to this tunnel are closed by wooden doors when the crushers are in operation. An exhaust fan connects with this tunnel and through conical dust traps, which deliver to the belt conveyor. The delivery from the exhaust fan goes to a settling chamber. The dust-settling plant is shown in Fig. 9. It works efficiently; within an hour after the starting of operations the atmosphere in the building is so clear

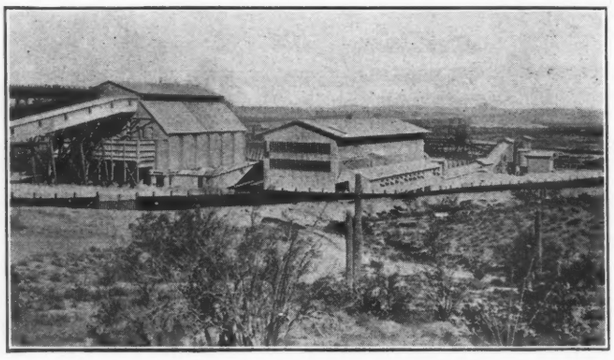


Fig. 7. The fine-crushing plant

that it is difficult to believe that dry crushing is in progress.

The ore as it leaves the Symons-crusher building is weighed by a Merrick weightometer, sampled, and then passes to the leaching vats, one of which is shown in Fig. 10. The sampling is done automatically across the stream of crushed ore as it falls from one conveyor to another, by means of a series of small sample buckets attached to chains, which pass over sprocket wheels. The sample, about fifty tons per charge, or 1 per cent of the total, is then passed through rolls, cut, mixed, divided, and quartered for assay. The reject passes back into the ore stream.

Charging the Vats

The crushed ore is distributed in the leaching vat by means of what is known as a spreader bridge. This consists of an automatic conveyor equipment, which receives ore from the main conveyor, then delivering it across the width of the vat. Chuquicamata practice is followed at Ajo. The distribution is started at the side of a vat and the ore is allowed to reach the maximum height before the distributor is moved. During this period the coarser particles roll to the bottom, the remainder forming an angle of about 45 deg. Filling is then continued by moving the spreader as required and allowing it to deliver, back and forth, so that the height of the charge is maintained. During this procedure the coarse particles continue to roll to the bottom of the vat, where they form a support for the material of finer texture. Filling of a 5,000-ton vat takes from twelve to fourteen hours.

The leaching vats are twelve in number. Each is 88 x 88 ft. by 17 ft. 4 in. deep, constructed of reinforced concrete (see Fig. 10) and with a wooden bot-

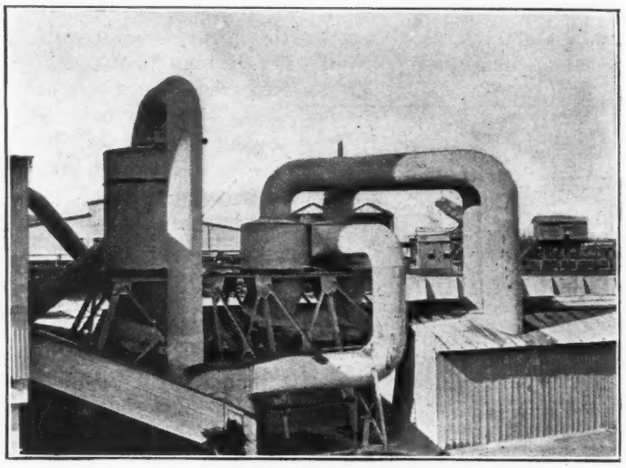


Fig. 9. Dust-collecting apparatus

tom. This bottom is made by laying a series of 3 x 8-in. pine planks edgewise on concrete foundations, the upper surface, protected with a covering of 6-lb. antimonial-lead sheeting, sloping to a center line. On top of this are placed 5 x 12-in. joists on edge, carrying the bottom support for the ore that consists of 2-in. planks with $\frac{3}{8}$-in. holes at 2-in. centers; these are countersunk from below.

The sides of the leaching vats are covered with 8-lb. lead sheeting, protected from abrasion by 2-in. planks held in place by vertical posts as shown in Fig. 15.

Fig. 8. One bank of Symons disk crushers

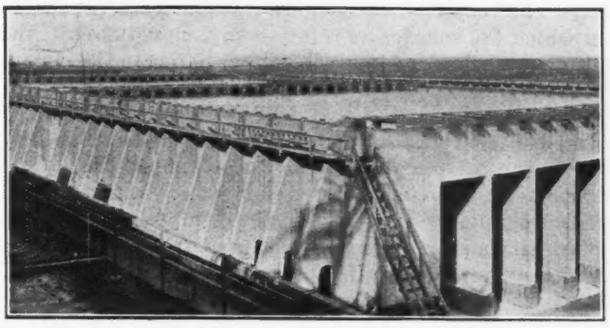


Fig. 10. One of the Ajo concrete leaching vats

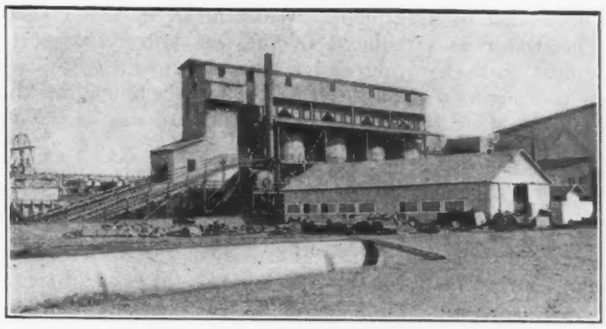


Fig. 11. The Wedge roaster plant

Overflow launders are provided along opposite sides of each vat. These deliver to the suctions of special vertical-spindle, centrifugal pumps, two of which serve each vat. Each is of 15-in. delivery diameter and connected direct with a 40-hp. motor. The piping is arranged so that the liquor can be circulated by the two pumps in the one vat, a proportion being bypassed to the vat next in the series.

The Three Features of Leaching Practice

The principal features of the leaching practice at Ajo are (1) upward submergence, (2) upward percolation, and (3) high rate of flow. The charge is first submerged with what is known as the acid advance, which is the solution from the electrolytic cells plus a necessary proportion from the storage vats. When the ore is covered to the requisite depth the circulation of the solution through the charge is begun and continued until the solution is clear. The vat in question is then coupled in with the main circuit, receiving solution from the vat most recently filled, and sending a high-copper solution, called neutral advance, to the reduction towers.

Reduction of Ferric Iron

In the reduction plant (Fig. 11) the sulphur in special Bisbee ore is used to produce the necessary sulphur dioxide. The ore, arriving by railroad, is crushed in a Blake breaker, then in a Symons 48-in., vertical-shaft disk crusher to 3 mesh. Distributing hoppers are arranged for the delivery of the ore to four Wedge roasters. These are 22 ft. 6 in. in diameter; they have seven roasting hearths and a drier or pre-heater hearth, making eight arches in all. The arms on the second, third and fourth hearths are cooled with water. The arms on the first, sixth, and seventh hearths are air-cooled. This combination of water and air-cooled arms in the same furnace is possible because of the size of the open shaft used. The furnace is made gas-tight, permitting control of draft; and the hot air from the air-cooled arms may be introduced into the bottom hearth for drafting the furnace, with damper control.

The gas from the roasters goes to a spray chamber, made of framework inclosing 8-lb. lead sheeting, in which the neutral advance solution is sprayed, and by which the temperature of the gas is reduced from 600 to 150 deg. F. The cooled gas passes to six towers, four of which are 40 ft. high by 20 ft. in diameter, and two are 40 ft. high by 28 ft. in diameter. These towers are arranged in pairs. A fan is placed in such a position and operates so that the gas is drawn through the first set of towers and forced through the second and third sets. The towers are suitably baffled with boards, thus insuring intimate mixture, the flow of gas being counter-current to flow of solution.

At the base of each tower is a lead-lined concrete sump, from which the solution is circulated by Antisell pumps, finally joining the effluent from the spray chamber. After settlement in one of the larger leaching tanks used for that purpose, the solution goes to the electrolytic cells. The clarification of the solution is accompanied by a further reduction of ferric to ferrous iron.

Leaching and Washing the Charge

When the solution from a new charge is taken for reduction and clarification and electrolytic deposition of copper, the solution from the vat next behind in the series is used to replace the neutral advance being withdrawn. A proportion of the solution in each vat undergoing treatment is being circulated continuously, a proportion also going ahead to the next charge. The pumps are shown in Fig. 12. The remainder of solution in the plant is maintained by the addition of water for displacement purposes to the vats approaching

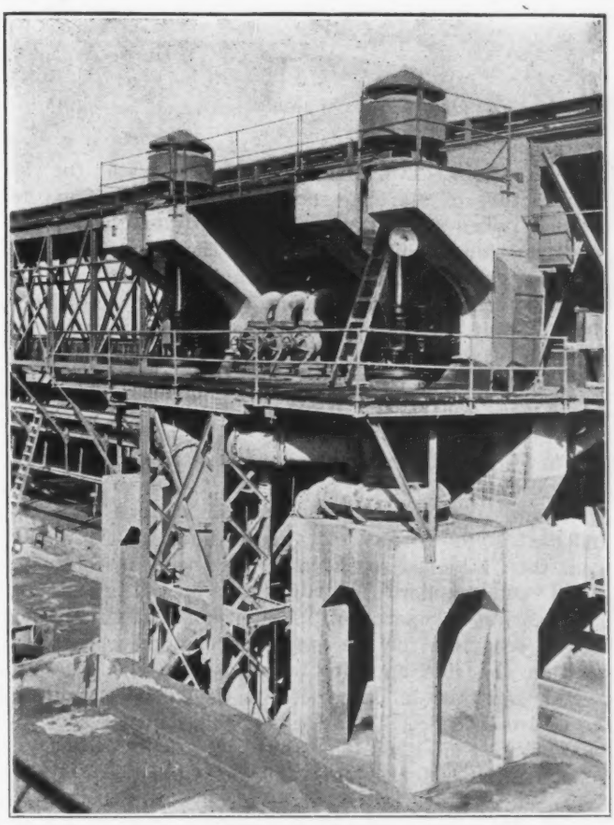


Fig. 12. Solution pumps

completion of treatment. Washing is in five stages. The water is circulated in the vat and returned to sumps, so that a progressive impoverishment of tailing is accompanied by a corresponding enrichment of the solution, which ultimately passes forward into the main solution circuit.

Recovery of the Copper

The solution from the settler, after treatment in the reduction towers, goes to the electrolytic cells, 152 in number and arranged in sixteen banks. Twelve of these banks comprise ten cells each; the remainder, eight. Each cell is a separate unit; it is constructed of wood, and lined with 7-lb. lead sheeting. The inside measurement is 29 ft. 7 in. by 4 ft. 3 in. deep. Each cell used for the production of commercial copper contains eighty-four anodes of lead alloyed with 3.5 per cent antimony. These anodes measure 40 x 51 x ¼ in.; they are submerged to a depth of 41 in., short-circuiting being prevented by glazed, conical, porcelain insulators, eight of these being attached to each anode. The alloy used has proved entirely desirable; little corrosion or wasting has occurred. Warping is unavoidable, but this is corrected without trouble, the anodes being straightened about every six months. The indications are that those anodes will outlive the plant.

The starting blanks, also of lead containing 3.5 per cent antimony, are 53 x 43 x ⅜ in., with anodes

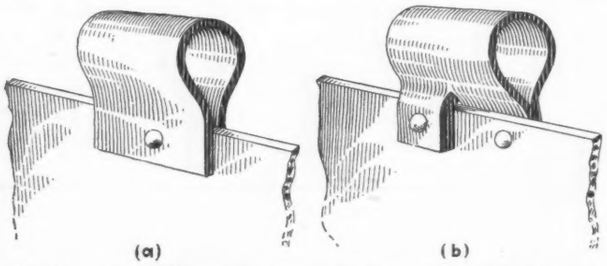


Fig. 13. (a) Ordinary loop connection. (b) Tobelmann-Montgomery loop connection

41 x 52 x ⅜ in. Twenty-five cells are set aside for the manufacture of starting sheets, which weigh from 15 to 18 lb. when ready for use. The ordinary loops used for suspension proved inadequate, the ferric sulphate and the gases dissolving the starting sheets at the points of contact with the loops. Originally these consisted merely of bent strips of sheet copper attached in the manner shown in Fig. 13 (*a*). The result was that short-circuiting with fallen cathodes became common, and damage was caused to the lead lining of the cells.

The trouble was overcome by an ingenious suggestion of H. A. Tobelmann, the metallurgist, and Harry S. Montgomery. This was to the effect that the ends of the strip of copper should be brought together, cut, and bent in the form shown in the illustration. These were then attached to the starting sheets by piercing in the usual manner. The suggestion proved practicable and was put in operation. As anticipated, no further trouble occurred, for the copper deposit grew in thickness on the side opposite to where the clip was attached, and thus in proportion to the added weight of the entire cathode. The idea was subsequently covered by Patent No. 1,269,485, June 11, 1918, issued to Tobelmann and Montgomery and unassigned.

The finished cathodes weigh from 130 to 140 lb. apiece. They are shipped for melting into standard shapes at the Raritan Copper Works, Perth Amboy, N. J.

In the majority of chemico-metallurgical processes, in which the solution is retained in a closed circuit, the ultimate fouling of the solvent with impurities is inevitable unless special precautions are taken. At Ajo it has been estimated that half of the acid consumed was utilized to dissolve copper, the remainder merely serving to bring into solution various impurities. This proportion has been altered appreciably of late, the reduction in the strength of the acid used being the principal cause of a diminution in the amount of impurities taken into solution. In any case, however, fouling is inevitable, and decreasing efficiency can only be prevented by the discard of an adequate amount of stock solution at intervals. A number of undesirable substances accumulate at Ajo, but an index of fouling is obtained by an analysis for iron, which is kept under 2 per cent.

The precipitation of the copper in the electrolytic cells is incomplete, so that plant solution that is discarded to prevent fouling must be treated by special methods to avoid an unnecessary loss of metal. As explained in an earlier installment, the fouling of the solution during the testing work became so serious that a proportion of the nearly neutral solution was isolated from circulation and passed over scrap iron to produce cement copper, which was afterward dissolved in a solution high in ferric sulphate. This procedure, which was put into practice, had the advantage that all copper produced was of the electrolytic variety. At certain times, however, the cement copper is shipped to Douglas for melting.

The equipment and practice in connection with precipitation by iron at Ajo calls for no special comment, except that compressed air is used to free the iron of precipitated metal and to assist in the movement of the solution. In spite of obvious criticism, the procedure is satisfactory, and no deleterious results are apparent. The impoverished solution flows to the desert. The accumulation of sulphate in one spot may eventually have some economic value. The scrap iron is handled by electromagnet, as shown in Fig. 14.

Discharging the Tailing From the Leaching Vats

The contents of each 5,000-ton leaching vat are removed in about nine hours by the aid of what is known as the stiff-leg form of excavator, built by the Wellman-Seaver-Morgan Co., and formerly referred to as the Hulett unloader. This is shown in operation in Figs. 15 and 16. It is a modified form of the machine used so extensively for unloading iron ore from steamers on the Great Lakes. The machine travels on runways, the structure spanning the vat. The bucket, which has a capacity of about 10 tons, is at one end of a rigid leg, which is suspended from a large beam. The motors and other mechanisms needed are situated on the other end of the beam, the pivot being placed so that the unloaded bucket can descend into the vat by gravity. The opening and closing of the bucket is effected by means of ropes operated from a drum that is geared direct to a 100-hp. motor. The bucket is hoisted by a movement of the beam that is controlled by a 150-hp. motor. The leg is rotated on its axis by means of a 25-hp. motor.

The operator's station is just above the bucket and so situated that he can control all the movements with precision. In Fig. 16 the operator is seen watching from the window of his cab the dumping of a bucketful

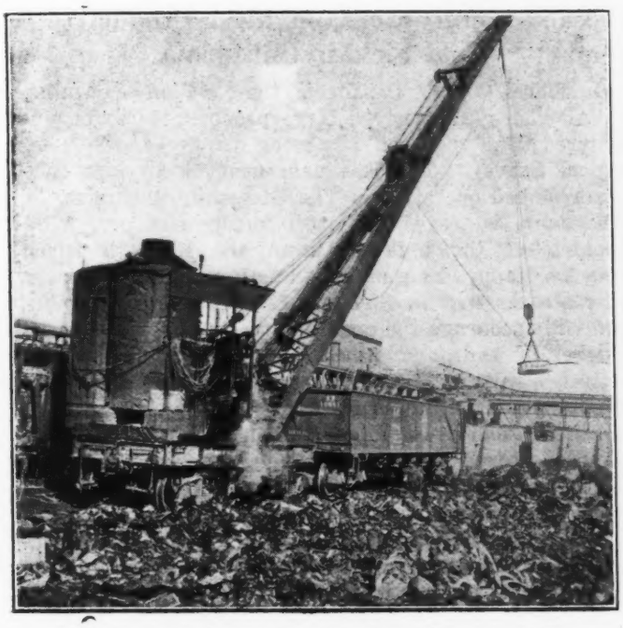


Fig. 14. Electromagnet for handling scrap iron

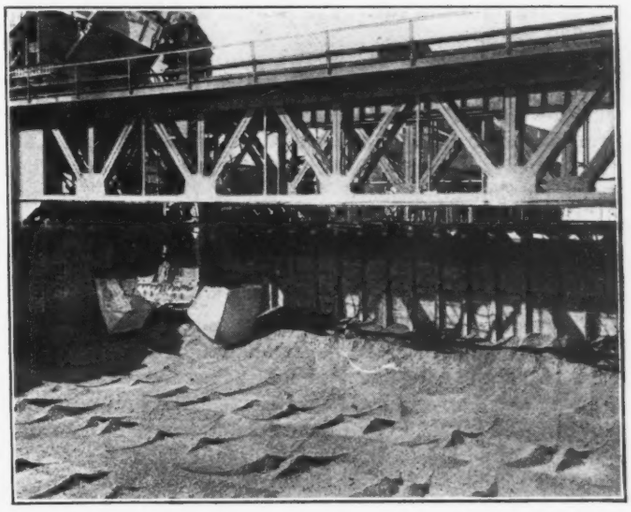


Fig. 15. W.S.M. excavator nearing completion of unloading of a leaching vat

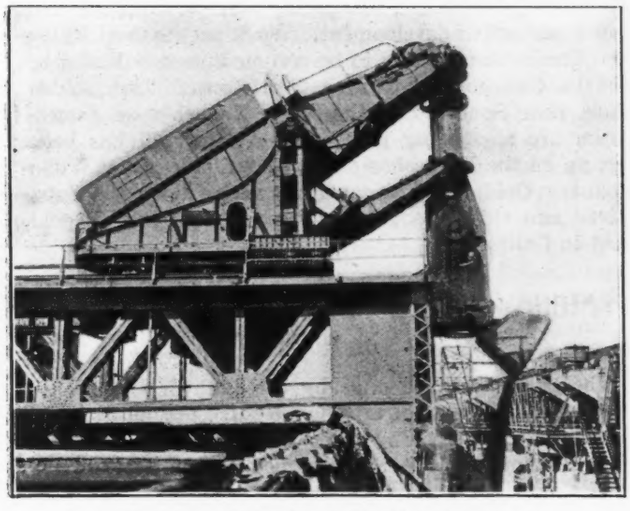


Fig. 16. Unloader delivering into car

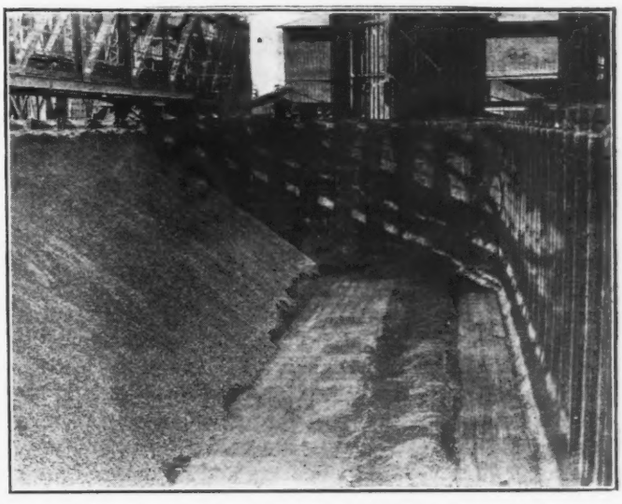


Fig. 17. Angle of repose of ore during filling

Fig. 18. On the residue dump

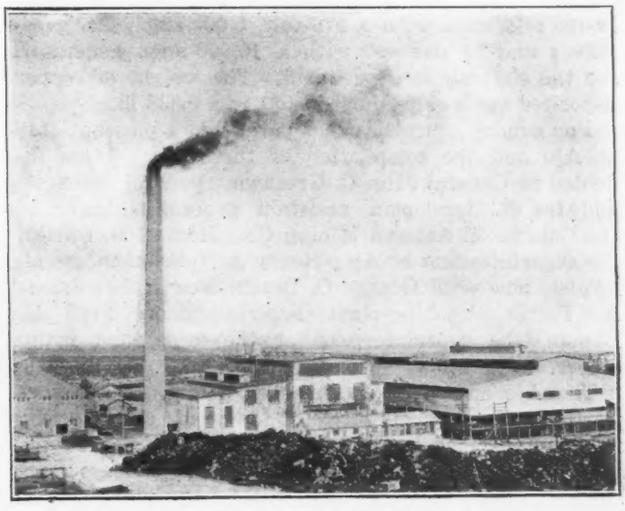


Fig. 19. Power house and electrolytic department

of tailing into the car. The motors use direct current at 230 volts.

The leaching vats are in two rows, separated by the central structure. The excavator is transferred from one row to the other by means of a table mounted on trucks and traveling on runways at right angles to the runways that parallel the two rows of vats. The same equipment is used for transferring the filling bridge and auxiliary apparatus from one row of vats to the other.

The unloader used makes a better job of clearing the bottom of a leaching vat than does a bucket of the clam-shell type. However, it is impracticable as well as unnecessary to remove the remnants of the residue. Fig. 15 shows how much is left after the usual procedure. At Ajo, as already mentioned, the bottom support for the crushed ore in the leaching vat consists of 2-in. planks with ⅜-in. holes, countersunk from the lower side. To facilitate even percolation it is customary, when mechanical excavation is completed, to have the remaining tailing shoveled by hand in the form shown in Fig. 17. Thus, before each filling, one-half of the bottom is cleaned, the position of the strips of heaped residue and cleaned bottom being alternately between charges.

Air-dump cars were chosen for the transport of the tailing to the dump, of the same size and make as those used for the conveyance of the ore from the mine to the mill. (See Fig. 18.) The equipment operates at maximum efficiency, and no time is lost, the discharging of cars being almost continuous when once they have been hauled to the dump. A dump is formed that is extended by the divergence of two tracks fanwise, the empties from either spur being pushed back by the same locomotive that pulled them out.

The power house, designed by Moore & Co., of San Francisco, under the supervision of A. G. McGregor, is to the left of the electrolytic plant, as viewed from the coarse-crushing plant (Fig. 19). Fuel oil is used in Stirling boilers, of which there are five, of 800-hp. apiece. Steam, at 225 lb., goes to two General Electric-Curtis turbines, each direct-connected with a 7,500-kw. generator. The usual economizers and condensers form a part of the equipment.

The power from the generators, of 2,300 volts, is distributed; a portion goes direct to the plant, mine and townsite, for power and light purposes. The remainder, nearly 80 per cent of the total, goes to four Westinghouse sets, each with a 170-volt, 5,000-amp., d.c. generator; and to one set with a 10,000-amp. generator, for the electrolytic department. The weight of copper deposited per kw.-hr. during 1921 was 0.838 lb.

For sundry courtesies that permitted a pleasant stay at Ajo and the compilation of these notes I am indebted to General John C. Greenway, general manager, and Ira B. Joralemon, assistant general manager of the Calumet & Arizona Mining Co.; Michael B. Curley, the superintendent at Ajo; Henry A. Tobelmann, metallurgist, now with George C. Beach, New York; James A. Potter, leaching-plant superintendent, Fred E. Ekman, the superintendent at the mine, and many others.

The Ajo enterprise has marked a distinct and forward step in the metallurgy of low-grade copper ores; future operations there will be watched with keen interest by mining and metallurgical engineers and chemists, few of whom can fail to be interested in progress made and anticipated.

Yuba County Contains Most Productive Gold Field in California

In Sierra County, California, the old Plumbago mine, at Alleghany, formerly a large producer, is to be unwatered and reopened according to the U. S. Geological Survey. The Eastman, near Goodyear's Bar, has resumed operations. The Sixteen-to-One mine, at Alleghany, is taking out exceptionally rich ore. The opening of the highway down the Klamath River between Happy Camp and Orleans Bar makes the lower Klamath country in Siskiyou County more accessible and will encourage the opening of new mines there. A number of hydraulic mines in this county are being actively worked this summer. The Yankee Hill Dredging Co., in Stanislaus County, has stopped operations and sold its dredge, and another company has installed a dredge near La Grange. In Trinity County the Lewiston Gold Dredging Co. has purchased the Martin ground on Trinity River, above Lewiston, and bought the old dredge of the Valdor company, which had worked out its ground. Both the Pacific Dredging Co. and the Eastabrook have given up the idea of resuming dredging. The Shasta Dredging Co. is drilling ground on the Van Metre ranch, near Minersville. The Strode mine, near Carrville, has been purchased by an Arizona company, and the mill has been started. At Shawmut, Tuolumne County, the Shawmut mine, of the Tonopah-Belmont Co., has eighty stamps dropping and continues active development. Work on the Gold Ridge and Tarantula mines is to be resumed, as it will also be on the Chileno group, near Tuttletown. The Golden Gate, near Sonora, and the Santa Ysabel, near Jamestown, are also being reopened. A new mill has been put up on the Horseshoe mine, near Challenge, in Yuba County. Gold dredging continues active along the Yuba River and this area is now the most productive gold field in California.

Milling Operations of Utah Copper Co. in 1921

The grade of ore treated by the Utah Copper Co. at the Arthur mill was precisely the same during 1921 as it was in the preceding year, according to the annual report, namely 1.16 per cent copper. The average recovery was 83.87 per cent, corresponding to 19.44 lb. of copper per ton of ore treated, compared with 81.38 per cent and 18.83 lb. of copper per ton for 1920. The average milling cost was $1.17 per ton, a decrease of 8c. per ton from the previous year. The concentrates produced during 1921 amounted to 55,666 dry tons, averaging 21.32 per cent copper, comparing with a grade of 16.45 per cent copper made in 1920.

The operating costs per ton on concentrating ore, including all fixed, general and maintenance charges for the years 1910 to 1921 inclusive, are shown below:

Year	Tonnages	Mining	Ore Delivery	Milling	Total
1910	4,340,245	$0.4097	$0.2978	$0.4663	$1.1738
1911	4,680,801	0.4479	0.3078	0.4168	1.1725
1912	5,315,321	0.4233	0.2848	0.4158	1.1239
1913	7,519,392	0.3288	0.2797	0.3676	0.9761
1914	6,470,166	0.3232	0.2782	0.3536	0.9550
1915	8,494,300	0.2441	0.2781	0.3402	0.8624
1916	10,994,000	0.2781	0.2792	0.3782	0.9355
1917	12,542,000	0.4446	0.2794	0.6930	1.4170
1918	12,160,700	0.5370	0.2983	0.9277	1.7630
1919	5,538,700	0.4900	0.3040	1.2062	2.0002
1920	5,556,800	0.4823	0.2591	1.2472	1.9886
1921	1,220,700	0.4998	0.1921	1.1679	1.8598

The Marketing of Magnesite

Crude, Caustic Calcined and Dead-Burned Material Sold—Domestic Industry Greatly Stimulated by the War—Principal United States Production from California and Washington—Chief Consumption in the East in Refractory and Cement Trade

By R. W. Stone
Assistant State Geologist, Harrisburg, Pa.

MAGNESITE is a little known but important non-metallic mineral. As an article of commerce it is used by comparatively few industries and they may rarely see it in the raw or crude state. The mineral is a magnesium carbonate, composed largely of magnesium oxide and carbon dioxide. The oxide is used, the gas is wasted. As the gas forms nearly 50 per cent of the weight, and is easily removed by heating. the rock is burned at the mine to save expense in shipping.

Magnesite occurs in two distinct forms, amorphous and crystalline. Amorphous magnesite, the common form, is a fine-grained, compact, white or cream-colored mineral; it has concoidal porcelaneous fracture, and is hard to scratch with a knife; it is usually found in veins or masses in serpentine. The deposits in California, Mexico, Venezuela, and Greece are of this type. Crystalline magnesite resembles medium to coarse-grained marble, and occurs as replacement masses in metamorphosed limestone, dolomite or associated sediments. The principal deposits of this class are in the State of Washington, Quebec, Austria, and Czechoslovakia.

Magnesite has two principal uses: as a refractory lining for metallurgical furnaces, and as a plastic material for floors and walls of buildings. It is put on the market in two forms, dead-burned and caustic calcined.

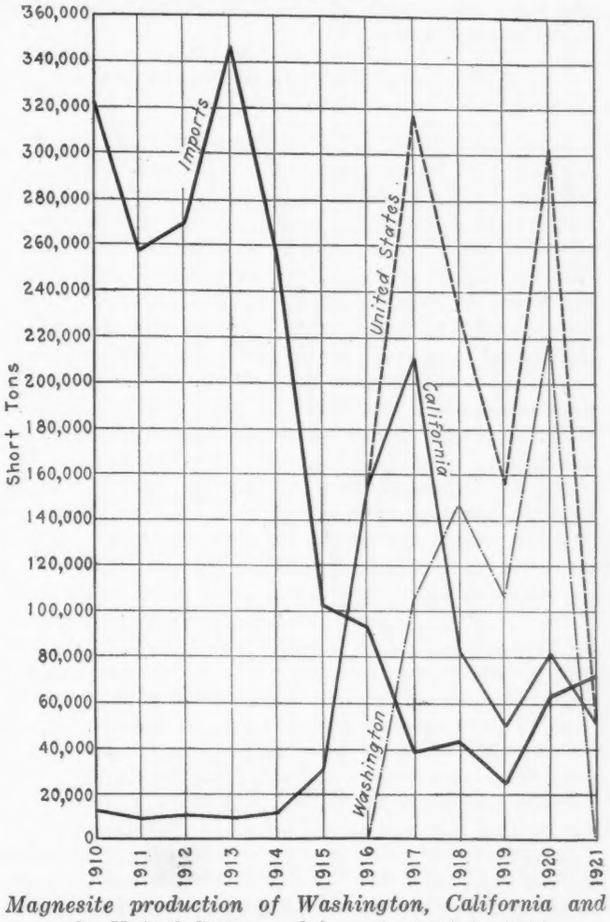
Dead-burned magnesite, or refractory calcines, is the better known and, so far, the most used. It is employed in grain form to make the bottom of open-hearth steel furnaces and as brick for lining furnaces and converters used in making steel and copper, and in rotary kilns. The consumption for these purposes may have reached its peak, because of changes in processes and the introduction of substitutes for magnesite.

Caustic calcined magnesite is used for the manufacture of oxychloride or Sorel cement. The use of magnesite cement for floors and as interior and exterior wall plaster is growing in this country and has an unlimited market to develop. Other uses of caustic calcines are for pipe and furnace covering, molded into sinks, bowls, and other sanitary fixtures, for light carbonate, and other minor products.

Magnesite in the dead-burned form is used by manufacturers of refractory products, in plants east of St. Louis, and in the caustic form by manufacturers of oxychloride cement in this same region and on the Pacific Coast. Much of the dead-burned magnesite used in the eastern United States, however, is imported from Europe. Before mining in Washington came to a standstill in December, 1920, the crude magnesite was being converted into synthetic ferromagnesite at the mine, and at the peak of production in California practically all the raw stock was calcined before marketing.

The chief markets for dead-burned magnesite are the steel plants between Baltimore and Chicago and for caustic magnesite the larger cities of the eastern United States and the Pacific Coast.

The consumption of magnesite in the United States has had a wide annual range in the last ten years, but in normal times approximates 300,000 short tons stated in terms of crude material. Consumption is production plus imports, as there are no exports.



Magnesite production of Washington, California and the United States and imports 1910 to 1921

The following table, taken from "Mineral Resources of the United States," gives the domestic production and the imports converted to the equivalent in the crude form.

TABLE I. CRUDE MAGNESITE CONSUMED IN THE UNITED STATES 1911-1921 IN SHORT TONS.

Year	Domestic Production	Imports	Total	Percentage Of Imports To Total
1911	9,375	270,098	279,473	97
1912	10,512	268,309	278,821	96
1913	9,632	347,428	357,060	97
1914	11,293	256,988	268,281	96
1915	30,499	102,913	133,412	77
1916	154,974	93,885	248,859	38
1917	316,838	38,208	355,046	11
1918	231,605	43,530	275,135	16
1919	156,226	25,321	181,547	14
1920	303,767	63,110	366,877	17
1921	47,904	67,569	115,473	58

The accompanying diagram shows very clearly the small domestic production and heavy imports up to

1914, the greatly increased output in both California and Washington during the war, the precipitous decline of imports when ocean shipping was restricted, and lastly the partial recovery of imports and marked decline of domestic production since 1920.

The minimum consumption was in 1915 when imports were cut off, owing to the European War, and in 1919, when the steel industry was stagnant. Consumption peaks were 1913, a normal pre-war year before imports were reduced; 1917, the year of war-peak production; and 1920, representing the post-war partial recovery of business.

In 1922 very little, if any, magnesite is being mined in this country for refractory purposes. The steel plants in California may be using local magnesite but the big steel centers in the Eastern States are using Austrian magnesite.

Chemical and Physical Requirements Variable

Crude Magnesite.—It is customary to ship crude magnesite in bulk and in lump form. It should be free from country rock and other impurities. For calcining in shaft kilns, the rock is used in lumps but for proper treatment in a rotary kiln it is pulverized. Manufacturers of Epsom salts and other chemicals require crude magnesite in lumps ranging from 4 to 14 in. in size because they find that lump material dissolves best in their solution tanks. Some users of crude magnesite believe that they should have white ore but those who have studied the question find that iron in quantities which stains the ore rather deeply does not injure their products.

Caustic Calcined.—No very definite limits can be set for the chemical composition of caustic calcined magnesite. Magnesium oxide content ranges from 72 to 90 per cent, lime from 2 to 6 per cent, silica from 3 to 15 per cent, and ignition loss from 1 to 15 per cent. It has been found impossible to make fixed limits for maximum percentage of any impurity, for with the possible exception of active or free lime, no impurity exerts a decided effect on the oxychloride cement reaction. The value of magnesite in an oxychloride cement accordingly cannot be determined from chemical composition. The ordinary specifications for size of plastic calcined magnesite are 97 per cent through a 100-mesh screen and 75 per cent through a 200-mesh screen, although greater fineness is sometimes desirable. Color is held to be an object by some users, but if the color is not deeper than deep cream, it is doubtful whether any difference in the finished cement product can be distinguished when compared with a cement made from pure white magnesite. Pure white ore ordinarily commands a premium and very dark plastic calcined magnesite is usually somewhat cheaper than the white or light cream material.

Caustic calcined magnesite should not be exposed to moist atmosphere for a long time before use, for it will lose its setting quality.

Dead Burned.—As its name implies, dead-burned magnesite is inert, has no reactive property with its chloride. Its function is simply to resist heat and basic fluxes. Therefore, in theory at least, any impurities which tend to decrease its refractoriness are undesirable. Too much silica is, of course, bad. But curiously, if the dead-burned calcines are entirely free from silica, or iron, or lime, they are almost useless to the trade, at least in the present technologic processes. Without these impurities they will neither frit together into grains in the calcining kiln nor will they bond together into brick. Therefore, although they all tend to reduce the refractoriness, small quantities of silica, iron and lime, perhaps 8 to 14 per cent of the total volume, are necessary to form the bond which results in the "grain" formation in the kiln. They form fusible slags and hold the refractory magnesium oxide together.

Austrian Product Hitherto Accepted as Most Satisfactory

Up to the present time, Austrian magnesite has been generally accepted as the most satisfactory refractory magnesite. In crude form it carries about 4 per cent of iron and alumina sesqui-oxides, 2 to 3 per cent silica, and ½ to 1½ per cent calcium oxide. As it takes about 2.2 tons of crude to make 1 ton of dead-burned, these percentages are doubled in the calcined product. As practically all American magnesite has a low percentage of iron, the principal producer of magnesite for refractory purposes mixed enough iron ore with the crude magnesite to bring the content of iron and alumina in the calcines up to about 7 per cent.

Dead-burned magnesite for use in the refractories trade must be low in silica (maximum 7.5 to 8 per cent) and low in lime (1.5 to 3 per cent). The material must have practically no loss on ignition and show no shrinkage on heating up to 3,000 deg. F.

Grain magnesite to be used in open-hearth steel and copper furnaces should be nodular and not over ⅝ in. in diameter; it may, though it does not always, command a slight premium over dead-burned magnesite in lump form.

There are no market requirements regarding the allowable percentages of impurities, or of moisture. The price is not influenced by size or shape of particles. A mixture of sizes ranging from approximately ½ in. to extremely fine particles is preferred to material which is either all fine or all coarse.

Producers Rarely Ship Less Than Carloads

In both the refractories and plastic trade, little magnesite leaves the producer's plant in less than carload lots. The minimum carload is about 20 tons and there is no maximum excepting size of cars or about 50 tons. Lots smaller than carloads are handled by jobbers at consumption centers.

There are no premiums and penalties provided for in payment for purchases, nor tolerances in weighing and analysis of magnesite for refractories, although some orders specify maximums and minimums in chemical composition. Terms are usually 30 days net. When magnesite is to be used for chemical purposes, a premium or penalty for magnesium oxide content is sometimes allowed. A 1-per cent increase in magnesium oxide content over the specified limit is frequently allowed a 50-c. premium; and there may be a corresponding penalty if magnesium oxide is reduced.

Sampling of Crude Lump Difficult

Standard sampling methods are used and the quality is judged from analyses or tests and appearances. There are no standard tolerances. The sampling of crude lump magnesite by the buyer is decidedly difficult and it is doubtful if any is done regularly and satisfactorily. The chemical manufacturer judges quality largely by the behavior of the material in his solution tanks.

Plastic calcined magnesite is sampled by taking small quantities from many packages in a shipment, mixing, and making tests on the mixed sample. Chemical analysis is sometimes made, but most reliance is placed on physical tests of oxychloride cement made from the sample. Standard tests for plastic calcined magnesite should shortly be developed by a committee of the American Society for Testing Materials.

Dead-burned magnesite is sampled and analyzed by standard methods. Quality, however, is judged by appearance as well as from analyses.

Mode of Shipment Varies

Crude magnesite is shipped in lump form, either in box cars or open-top cars. Plastic calcined magnesite preferably is shipped in paper bags, paper-lined burlap sacks, containing 150 lb. each, and in paper-lined barrels. Some calcined magnesite is shipped from the Pacific Coast in bulk in box cars to grinding plants in the Central and Eastern States. The ground magnesite is later packed in sacks of 150 lb. with or without paper lining. Dead-burned magnesite is ordinarily shipped in bulk in box cars. Water does not damage this material. If in grain form, it is sometimes or usually shipped in bags containing 200 lb.

Foreign calcined magnesite always arrived in sacks, and for some time after foreign shipments ceased, steel works continued to ask for dead-burned magnesite shipped in sacks, because so many sacksful was the customary measurement among the men using grain magnesite in furnace bottoms. The steel works, however, became reconciled to using domestic magnesite shipped in bulk.

Some specify a minimum carload at 80,000 lb., and to secure the commodity rate on the railroad the material is released to a valuation of $10 per ton. The maximum carload is 50 tons, or the limit of car capacity. For local shipments in California, cars of 30 tons may be shipped.

Insurance Not Customary

In general, magnesite is never insured except against loss at sea. Plastic calcined magnesite is not ordinarily insured in transit. Damage is done sometimes by a leaky car roof but carriers promptly allow claims for such damage.

Magnesite is quoted on a fixed price per ton. Usual terms are net cash thirty days from date of invoice. Most of the plastic calcined magnesite shipped from California is sold on a sight draft basis. In some cases thirty or forty-five-day trade acceptances are allowed. Jobbers and local dealers sell small lots on more lenient terms, but little long-term business is handled by the producer.

Less Than Twenty Years Supply in Washington and California at 1920 Production Rate

The State of Washington could produce dead-burned magnesite sufficient for the steel industry, and Washington and California could supply the caustic calcines for the magnesite stucco and flooring industries, at the 1920 rate of production, for comparatively few years. That is, these states have the ore, and their mines and quarries have the capacity to meet the needs possibly for less than twenty years, if this country continued to consume magnesite as fast as in 1920 and relied wholly on the domestic supply.

Normally almost no magnesite leaves the mines in the crude condition. Marketing problems pertain, therefore, only to caustic and dead-burned magnesite. Caustic-burned magnesite has the entire United States for its market. Probably California and the Chicago district use more magnesite for stucco and flooring than other parts of the country, with the New York-Philadelphia district ranking third. Pacific Coast magnesite takes care of the Western and Central States, and even secures business in New York and other eastern cities. The Atlantic Coast, however, has received calcined magnesite from Greece for many years. Importations from Greece were discontinued in 1916 but resumed in November, 1920. An American firm operating in Venezuela brought 2,300 tons in the eastern market in September, 1920, and 1,100 tons in December, 1921. It is only natural, in view of the low ocean rate and high cost of transcontinental freight, that the Eastern States should buy foreign magnesite. Indeed, the producers of domestic magnesite would seem to be fortunate in having so much of the United States for an exclusive market.

The market for dead-burned magnesite is a very different matter. The steel industry is the large consumer, which means that the principal market is east of the Mississippi River and north of a line through the mouth of the Ohio.

Steel Industry Using Dead-Burned Magnesite from Europe

Until 1917, the refractory trade had been supplied with magnesite from Austria and Hungary. Then, under necessity, magnesite from our Western States and from Canada was used. The price, of course, rose. As a result efforts were made to find a cheaper substitute and sintered dolomite was employed as a refractory lining for metallurgical furnaces. The steel industry is now using dead-burned European magnesite as it did before the war, paying about $28 to $30 f.o.b. cars Baltimore, Md. The plant that produced most of the domestic dead-burned ferromagnesite during the latter part of the war has been closed since Dec. 31, 1920, presumably for lack of orders at the price asked. It is believed by some that if for any reason the price of dead-burned magnesite should be materially increased over that paid now for Austrian grade, the steel industry would discontinue the use of magnesite and substitute sintered dolomite. Of course, a sufficient reduction in price of the domestic material would put it again on the market.

Dead-burned magnesite used in the refractories trade has no special marketing problems because of the physical and chemical character of the material. It is not injured by exposure to weather and large stocks can be held. Practically all of the dead-burned magnesite consumed in this country is sold by a few of the larger refractories companies, as the American Refractories Co., General Refractories Co., Harbison-Walker Co. and Stowe-Fuller Co.

On the other hand, plastic calcined magnesite is handled on a retail basis through building-supply agencies, and as the material deteriorates with age it cannot be stocked for long but must practically be made to order.

Before the war the price of Austrian crude magnesite per short ton delivered on our Atlantic seaboard was $9 to $10, and Grecian crude was generally valued at a little more than $10. California crude magnesite was about $8 a ton at the mines. The average price of

European calcined magnesite was about $16.25 a short ton, and dead-burned Austrian magnesite sold as low as $15.75 f.o.b. docks at Philadelphia, and $15.60 f.o.b. New York.

In 1921, according to the United States Geological Survey, the average value per ton of all crude magnesite sold or treated in California was $10.65. The price as marketed was variable and much higher. Most of the product was sold in the calcined form and the price varied with the color, whether lump or ground, whether packed in paper-lined barrels or shipped in bulk, and on the size of the order.

The market report published in the *Engineering and Mining Journal-Press*, July 8, 1922, was as follows:

Magnesite—Crude, $8@$12 per ton. High-grade caustic calcined, lump form, $30@$45 per ton. Plastic calcined, $45@$50 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead-burned Austrian grains, $30 per ton, f.o.b. Baltimore, Md.

Quality Figures in Selling Plastic Calcines

Although crude magnesite is sold largely on a price basis, the quality enters into the sale of plastic calcines. A product which experience has shown to be uniformly of higher quality than the current average of commercial materials can usually secure a premium over such products. The current price for calcined plastic magnesite, ground and packed in bags, is between $43 and $47 per short ton, f.o.b. producer's plant. Packages are included and are not returnable for credit. These prices are for high-grade material of superior physical properties. Lower prices may be obtained on inferior material. Contracts of 500 to 1,000 tons will take a reduction of $1 to $2 a ton from the above prices, depending on size of contract. California producers who have a long haul to the railroad and must shut down during the rainy seasons when roads are bad may make price concessions in order to move the maximum quantity of material just before the shut-down.

Prices Normally Fluctuate Little

Under normal conditions there are no great fluctuations in the price of magnesite. Less than carload quantities sell for a slight advance over carloads. The demand for the material is not affected by the period of the year. The use of magnesite refractories in the steel industries has no seasonal fluctuations, and as oxychloride cement, the form in which most plastic calcines is used, can be supplied in freezing weather, the demand for it is only slightly seasonal.

Dead-burned magnesite has been imported from Austria for many years, and calcined magnesite from Greece. The following table shows the quantity of magnesite imported in recent years:

TABLE II. MAGNESITE IMPORTED FOR CONSUMPTION IN THE UNITED STATES 1914-1921

Year	Crude		Calcined (not purified)	
	Tons	Value	Tons	Value
1914	13,354	$54,677	121,816	$1,323,194
1915	49,764	255,140	26,574	232,071
1916	75,345	634,447	9,269	204,183
1917	30,277	232,105	3,965	232,601
1918	5,432	103,233	19,049	824,022
1919	6,381	103,311	9,471	270,721
1920	33,549	406,204	14,779	373,165
1921	51,993	525,452	6,788	250,932

This gives total imports of 58,781 short tons in 1921, valued at $776,384. The origin of these imports as reported by the Bureau of Foreign and Domestic Commerce, Department of Commerce, is shown in Table III on the opposite page.

This table, however, is somewhat misleading for most of the magnesite credited to Italy, although shipped from Trieste, originated at Radenthein, Austria, and that shipped from Germany was mined in Austria or Czechoslovakia. Magnesite imported from Netherlands was either from Austria or Greece originally.

Domestic and Foreign Magnesite Compared

Probably there is no physical difference between the crude white Californian and Grecian magnesite for plastic purposes. With calcined material, however, it is presumed that California magnesite calcined in a rotary kiln with pyrometric control is better conditioned than any other plastic calcines.

There is very little difference in quality between Washington and Austrian magnesite for refractories. It has been claimed that where records have been kept in the steel and copper industries, costs of magnesite have always been lower when the Austrian was used. This may have been true when compared with Canadian magnesite or with the early domestic product, but I doubt if any appreciable difference could be recognized by an impartial observer between the quality of staying power of the dead-burned magnesite made in Washington in 1920 and the Austrian. The fact that the iron occurs naturally in the Austrian ore and was synthetic in the Washington product and therefore regulated to the proper amount is immaterial, as is also probably the slight difference in silica content.

Standards for Plastic Calcines Developed

To round out this article it seems fitting that a statement be included concerning advances being made in the method of calcining and in standardizing the product. The Northwest Magnesite Co. co-operated with the Berkeley Station of the U. S. Bureau of Mines in a laboratory investigation of different methods of calcining. The Bureau of Standards has made numerous experiments in calcining magnesite, using a miniature electric furnace. The National Kellastone Co. has been studying to improve calcining practice in a rotary kiln at Porterville, California, and the American Mineral Production Co. has built special kilns for this purpose near Valley, Wash.

The following statement regarding specifications is from a recent letter by H. F. Wierum, general manager of the American Mineral Production Co., of Valley, Wash.:

"The chemical requirements for plastic calcines are, within certain limits, of very little consequence. As burned by this company, the only detrimental effect of such impurities as silica and lime, is the lowering of the percentage of MgO. It is perhaps fully in place here to state that this company was the first company to point out plainly the fact that lime is detrimental only when it exists as the oxide. When the crude magnesite is calcined at a temperature far below that at which the calcium carbonate is decomposed, any lime that was present in the crude rock as carbonate, still existing as carbonate in the calcines, is as inert and free from chemical action as so much silica. Marble dust, as you doubtless know, is a favorite ingredient of many oxychloride mixtures, and this fact helped us greatly in convincing the flooring and stucco people that whatever small quantities of lime may be present in our plastic calcines are harmless. Recently, however, this very vital fact has been recognized by a great many producers, and efforts are being made to calcine within the limits of temperatures which leave the lime present as carbonate.

"It is not exaggerating to say that one of the main reasons why magnesite composition products, such as mag-

TABLE III. MAGNESITE, NOT PURIFIED, IMPORTED INTO THE UNITED STATES IN 1921, BY MONTHS AND COUNTRIES

Country	January		February		March		April		May		June		July		August		September		October		November		December		Total 12 Months	
	Tons	Value	Tons	Value	Tons	Value	Tons	Value	Tons	Value	Tons	Value	Tons	Value	Tons	Value	Tons	Value	Tons	Value	Tons	Value	Tons	Value	Short Tons	Value
Austria	.....	.....	..	...	3,379	$83,997	..	...	....	.....	.....	.....	4	$75	6,117	41,332	.....	.....	.....	.....	.....	.....	270	7,434	9,496	$125,329
Canada	.....	.....	..	...	40	1,612	50	$3,313	50	$1,378	.....	.....	.....	.....	.....	.....	.....	$8	13	1,375	.....	.....	.....	.....	427	15,195
Czechoslovakia	213	4,309	...	...	.....	.....	...	.....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	213	4,309
England	.....	.....	...	...	.....	.....	...	.....	....	.....	1,745	18,901	955	8,033	298	10,022	.....	.....	303	9,552	560	15,250	11	255	3,884	62,415
Germany	12	402	...	...	.....	.....	...	.....	....	.....	4,480	40,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4,480	40,000
Greece	.....	.....	...	...	.....	.....	...	.....	....	.....	.....	.....	.....	.....	28	1,150	.....	.....	.....	.....	.....	.....	.....	.....	28	1,153
India-British	4,382	24,168	...	...	4,244	49,667	...	.....	5,952	41,831	1,407	11,825	.....	.....	3,357	60,015	9,380	107,018	2,880	25,733	.....	.....	4,519	45,486	36,121	365,743
Italy	282	16,637	1	$95	100	5,971	315	18,155	33	1,916	207	11,518	237	12,056	149	6,460	100	6,092	431	20,018	459	22,451	601	28,141	2,914	149,415
Netherlands	.....	.....	...	...	.....	.....	...	.....	....	.....	.....	.....	33	2,022	.....	.....	33	2,085	.....	.....	19	2,324	.....	.....	90	7,482
Scotland	.....	.....	...	...	.....	.....	...	.....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4	956	1,120	4,000
Venezuela	.....	.....	...	...	.....	.....	...	.....	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,120	4,000	.....	.....
	4,889	45,516	1	95	7,763	141,247	365	21,468	6,035	45,125	7,839	82,244	1,231	22,614	9,949	118,979	9,513	115,203	3,631	57,205	1,038	40,025	6,527	86,663	58,781	776,384

nesite flooring and stucco, found such little favor for so long a time, was that no two shipments, even when from the same mine and the same calcining kilns, could be counted upon to act the same, or to be uniform. This was because sometimes more and sometimes less of the rock was always overburned or underburned, according to the eye or the whim of a burner; therefore when this company started to make absolutely uniform calcines, and designed entirely different kilns with this end in view, it is not surprising that the idea of regulating both time and temperature of calcining to a nicety found favor and is now being adopted by many prominent producers.

"The calcines now being produced by us are made under absolutely uniform and unvarying conditions. Every carload, every ton, it might almost be said every sack of calcines produced, is made from rock of the same analysis and the same size, calcined at temperatures which do not vary 15 deg. C. and for periods which do not vary 15 minutes from pre-determined conditions.

"In view of all the above, both producers and consumers are now working together very heartily toward a set of physical specifications to govern shipments, which will completely do away with the necessity of chemical analysis. All details have not as yet been agreed upon, but certain producers are represented on a committee which is slowly working toward agreement on all points. So far we have about agreed on the following: First, on a typical stucco mix containing not more than 18 per cent of calcines and not less than 12½ per cent, and the balance consisting almost entirely of sand of different fineness and a little asbestos, the shrinkage or expansion shall not be greater than plus or minus $\frac{1}{10}$ of 1 per cent in 48 hr. after setting, or plus or minus $\frac{1}{100}$ of 1 per cent after full maturity. Second, that the modulus of rupture shall be not less than 550 lb. in 24 hr. After final set, and not less than 1,000 lb. seven days after final set, and that it shall be greater at three months than at seven days, and greater at one year than at three months. Third, the tensile strength at 24 hr. age shall be not less than 300 lb. to the square inch, and not less than 500 lb. at seven days. Fourth, that the effect of water shall be such that three periods of 12 hr. each, during which samples shall be continuously sprayed with water equal to the hardest rain, separated by two periods of 12 hr. each of drying in normal air, shall not reduce the modulus of rupture more than 60 per cent, tested immediately after the third soaking while still containing the maximum amount of water, and that upon thorough drying in normal air and temperature such samples shall recover their strength up to at least 80 per cent of their original strength measured fourteen days after setting. Fifth, the setting time is usually specified to be about as follows: The initial set to occur in not less than one hour and not more than four hours, and the final set to occur in not less than two hours and not more than six hours.

"These specifications are not as yet fully agreed upon, or adopted, largely because flooring manufacturers do not use anything like the mixture quoted above, and cannot draw any intelligent conclusions from tests of such mixtures. They demand (and I am one who is heartily in accord with the demand) tests on mixtures which approach as nearly as possible mixtures used by them, and this company is adopting this principle in its shipments to flooring people, making tests wherever possible, on the exact mixtures which are to be used by the consignee, or where this is not possible, making tests on typical flooring mixtures when the calcines are to be used for flooring, and on typical stucco mixtures when the calcines are to be used for stucco.

Conditions Governing Tests Yet to Be Agreed Upon

"Another point which is not fully settled, but which probably soon will be, is the matter of conditions which shall govern the making of tests, such as temperature of the atmosphere, humidity, and altitude. These are really difficult to govern; for instance, if a set of twelve test bars is laid on an iron plate where the temperature of the room is 70 deg. and if a so-called 'setting pat' is laid in the same room on a glass plate covered with oiled paper, it has been found repeatedly that the time of both initial and final sets may vary 25 or 30 per cent as between the test bars and the setting pat, as measured by the Gillmore needles. Again, it is proposed that the curing of test bars and briquettes shall be done between the temperatures of 60 and 80 deg. F. Frequently we find a difference of 25 per cent in both tensile strength and modulus of rupture, as between these two extremes of temperature; and to make matters worse, in case the temperature of the curing room should happen to go to 90 deg. or 95 deg., which is sometimes difficult to prevent on warm summer days, it is found that results will be as much as 100 per cent higher than the same test mixes would show at 65 deg. F.

"All these and many other matters are being thrashed out, and it is hoped to secure a thoroughly reliable set of specifications by which the excellence of any sample of magnesite can be accurately and scientifically measured and stated. We have gone far toward this goal already, and consumers certainly appreciate the improvement. little or no talk is now heard of the chemical analysis required of a plastic calcine. Consumers want only to know how strong it is, how quick it will set, how much it will shrink or expand, and how resistant it is to water, and these things we are giving them within very narrow limits of error already.

Differences in Calcination

"The behavior of the California magnesite, which is amorphous like the Grecian, is very different, when it comes to calcine, from the behavior of the Washington magnesite, which is crystalline. Nine hundred to 1,000 deg. C. does not seem to impair the setting quality of the amorphous magnesite, whereas any temperature above 750 deg. C. practically destroys the setting quality of the Washington crystalline magnesite. Consequently the method of treatment best suited to each variety cannot be compared. The time during which magnesite is subjected to heat has a very important bearing upon the setting quality and strength, upon the resultant calcines, and also upon the water resistance.

"If tests now being made by this company are successful, it is hoped to provide a method whereby the actual activity

of the MgO contents of any calcines can be accurately measured and compared. Before attention was paid to the fine points of calcining, nearly all shipments were found to contain certain proportions of both dead-burned and under-burned material, and as these proportions varied, so did the strength and activity of the calcines vary in the formation of magnesium oxychloride. It frequently happened that a calcine showing by a chemical analysis, say, 88 per cent of MgO would not make nearly so strong a cement as some other calcine showing but 70 per cent of MgO. This was because a greater proportion of the latter was active, and it has been found that it is possible to calcine the crude in such a manner that all of the MgO present as such will be active. This is but another instance of the totally wrong conclusions that can be, and in fact that were for many years, drawn from chemical analyses, and if, as we hope, it is going to be possible to state accurately just how active a certain calcine is, it will surely be a great step forward.

"Even this, however, without certain qualifying data, might be misleading because the water-resisting quality of a calcine by no means necessarily follows the chemical activity in the formation of oxychloride.

"You can readily see from all the above that we have undertaken a highly technical, extremely interesting, and very important development in our efforts to reduce the oxychloride cement industry to a scientific and reliable basis. We feel that this is the only way of increasing the usefulness of this most important cement, and thereby increasing its consumption.

"Not to leave the question of the potentialities of the business altogether untouched upon, I might say that in the year 1921 over 40,000 houses were covered with magnesite stucco, in the east and middle west, and that approximately 36,000 tons of plastic magnesite were consumed in the oxychloride cement business in America. The cooperation between producers and consumers and the marked improvement in the scientific treatment of the industry is having its inevitable effect, and we confidently look forward to a time not many years hence when the production and consumption of plastic magnesite will greatly surpass the production and consumption of dead-burned."

Need of Perfecting Calcination Methods

Here, in the present writer's opinion, is the situation. The market for dead-burned magnesite is not likely to increase much and may decrease. On the other hand, the market for plastic calcined magnesite can be extended tremendously. There would seem to be no limit to the demand that might be created for magnesite as a covering for exterior and interior walls and floors of buildings. A demand can be developed, however, only on a standardized and dependable article. Mr. Wierum, as shown above, Max Y. Seaton, technical director of the National Kellastone Co. and C. S. Maltby, of San Francisco, are especially active in working toward the desired goal.

The domestic producer of plastic calcined magnesite has a large part of the United States as uncontested market anyway, and I believe should compete successfully in the rest of the country (the Atlantic Coast) on a quality basis when the dependability of the domestic product is recognized by the consumers. This condition can be brought about by perfecting the method of calcining. When that is done and the product is thoroughly reliable, the marketing of magnesite will be easier than now.

Acknowledgments

I acknowledge my indebtedness for information contained in this article to H. F. Wierum, American Mineral Production Co., Max Y. Seaton, National Kellastone Co., A. F. Greaves-Walker, American Refractories Co., and J. Spotts McDowell, Harbison-Walker Refractories Co.

Activity in Metal Mining Increases in Nevada

The mines of Nevada, especially the silver mines, showed increased activity during the first six months of 1922, according to V. C. Heikes, of the U. S. Geological Survey. The copper mines are just again becoming productive, the zinc mines and most of the lead mines are at a low ebb, but the silver mines and many of the gold mines are rapidly returning to a normal output. In 1921 the value of the metal output was $12,137,536, which is less than the value in any year since 1905.

The gold mined in Nevada decreased from $3,566,728 in 1920 to $3,312,757 in 1921. The production of gold in Nevada has steadily decreased since 1910, and no increase in the state output is expected in 1922, as many of the mines have been idle half the year. Mining in the Tonopah district, which produced gold valued at $999,094 in 1921, has improved steadily since the labor strike in 1921, and several companies have increased their ore reserves. The quantity of gold obtained from copper ore will probably be greater in 1922, as the mines at Ely were preparing for active operations in May. The shipments of gold ore from Goldfield increased considerably, especially from the Silver Pick lease, on Red Top ground, and a larger gold output was expected from the Round Mountain and Battle Mountain placers. Mining and mill building have progressed at Virginia City, but in May several of the producing properties stopped development work below the Sutro tunnel. At Gold Circle the mill of the Elko Prince Mining Co. was destroyed by fire, but a new mill is planned for the Big Chief mine.

Selenium and Tellurium Increase Efficiency of Gasoline

Authoritative reports from the laboratories of the General Motors Co. give information that by the employment of selenium oxychloride or diethyl telluride the efficiency of a given amount of gasoline can be doubled, according to the *Journal* of the Franklin Institute. The data have been obtained by Midgley and Boyd. The tellurium compound was the most efficient, and is especially advantageous in eliminating the "knock" developed when a motor is laboring on a grade.

Victor Lenker states that if only one-hundredth of 1 per cent should be used in gasoline the amount of tellurium required for the gasoline used at present in the United States will be 1,500 tons. In 1920 it was ascertained that without further plant equipment the country could produce only a little over 60 short tons.

It will be necessary to find new sources of tellurium and also of selenium if these materials are to be extensively employed. A very important point will be the sanitary problems, which apparently have not yet been considered. Selenium and tellurium compounds are mostly quite poisonous.

Reserves of Fluorspar Are Limited

R. B. Ladoo, mineral technologist of the U. S. Bureau of Mines, recently spent a month in the southern Illinois and western Kentucky fluorspar field. The outstanding feature of the fluorspar situation is that our known reserves are low, and, unless new deposits are found, fluorspar will be very scarce and expensive within a few years. The development of possible substitutes is being considered.

Mineral Resources of Cuba

Iron, Manganese, Chromite and Other Ores Occur on the Island—Existence of Low-Grade Copper Deposits Suggested — Indications of Petroleum Are Widespread

BY EDUARDO SUÁREZ MURIAS

COMPARATIVELY LITTLE is known about Cuba's mineral resources, despite its excellent geographical position. This is due mainly to defectiveness of its mining laws, political unrest, and lack of interest on the part of the government.

Cuba forms part of a geosyncline over 2,000 kilometers long, which extends southeastwardly to and including the island of Porto Rico. Its general direction is noticeably parallel to the chains of mountains of southern Mexico and Central America.

Beyond a few reconnaissances of a superficial character, little attention has been given to the study of the country's geology. A geologic sketch made over forty years ago mentioned small areas of Paleozoic ground in Pinar del Río and Santa Clara provinces. Triassic slates and Jurassic limestones are moderately extensive, particularly in Pinar del Río. Tertiary strata, chiefly limestones, predominate. Great upheavals occurred in the early Tertiary, accompanied by extensive invasions of magma, which issued along wide crevasses many kilometers in length, in some places piling itself up several hundred feet into small chains of mountains and in others rising but little above the general level of the country, in most localities overflowing the adjacent territory in streams of variable fluidity, as the resulting topography attests. Thus it was that the country, parallel to its main axis, was divided into alternating belts of igneous and sedimentary rocks, subsequent depositions having further contributed to this subdivision.

Intense folding and faulting are charactertistic of the early Tertiary, Jurassic, and Triassic strata, observed wherever railroad and highway cuts, underground workings and natural exposures have made visible the stratigraphical conditions of the subsoil. A major system of faults runs parallel to the main axis of the country, with numerous minor faults at angles to it. The presence of most delicate folding in Jurassic limestones, as, for instance, near Cabezas, Pinar del Río, denotes the existence of long periods of dynamic stresses ages before the Tertiary upheaval.

Most of the various types of igneous rocks are basic—namely, serpentinized peridotites, diorites, gabbros and the like, intruded by dikes of andesite, basalt, and other rocks. The less abundant acid rocks are found mainly in Santa Clara and Oriente provinces as granites, trachyte, rhyolite, obsidian, and others.

Extensive deposits of limonite are found in the Province of Pinar del Río, specularite in Havana (Isle of Pines), magnetic iron in Matanzas, limonite in Camaguey, and limonite and hematite on the northern and southern coasts, respectively, of Oriente. The deposits in this last province have been worked for years. At present they are being exploited by a subsidiary of the Bethlehem Steel Co. The annual output fluctuates considerably. For several years prior to 1914 about 1,500,000 tons was shipped from them to the United States. Ores from the southern coast run approximately 55 per cent iron, 7 per cent silica, ¼ per cent phosphorus, and ½ per cent sulphur; those from the northern coast are characterized by the presence of about 1.98 per cent of nickel and chromium combined and a low phosphorous content, about 0.06 per cent, as well as by their loose earthy texture. This ore is put through a process of dehydration and nodulization before it is shipped. The nodules thus formed run 55 per cent iron, 15 per cent alumina, and 4 per cent silica. The ore reserves in Oriente alone exceed 3,000,000 tons, which, with the estimated contents of the remaining occurrences in Cuba, makes a total of approximately 4,000,000 tons. The deposits of Pinar del Río, Havana (Isle of Pines), Matanzas, and Camaguey have never been exploited.

ORIENTE THUS FAR ONLY MANGANESE PRODUCER

Manganese occurs in Pinar del Río, Santa Clara, and Oriente, and although exploration work has been done in these three provinces, Oriente has been the only producer so far, particularly during the war. Practically all Cuban manganese is furnace ore, and production has always required an active market to make it pay, because the ore is of a disseminated character and transportation facilities are inadequate. The ore is mostly pyrolusite, and usually occurs with limestone. The reserves in Oriente are estimated at 1,000,000 tons. With the exception of a small mine where chemical ore is produced, all operations ceased soon after the war. The ordinary run of the Cuban ore analyses about 39 per cent manganese, 12 per cent silica, and somewhat less than 1 per cent of phosphorus.

Chromite is widely distributed in the provinces of Matanzas, Camaguey, and Oriente, deposits of less importance also being found in Havana. It occurs in serpentinized peridotites as magmatic segregations. Little has been done so far toward developing this mineral. Interest in it was first aroused in 1917, and chiefly in the beginning of 1918 when the United States Government sent a commission to investigate reported manganese and chromite deposits in the West Indies. With the termination of the war the price of chromite fell rapidly, and the work started in various localities gradually ceased. The ore is fine grained to granular, with spotted and solid bodies intermingling. From results thus far obtained it appears reasonable to expect that an average grade of 45 per cent chromic oxide should be obtainable at the various deposits by means of concentration. Based on the abundance of outcrops and the workings at Matanzas, Camaguey, and Oriente, the reserves of marketable ore may be placed at half a million tons.

COPPER OCCURS IN ALL PROVINCES

Indications of copper are found in numerous localities. Exploration work has been done in all six provinces, and so far good results have been obtained in Pinar del Río and Oriente, where outcrops are more numerous and promising. The El Cobre copper mine, in the Sierra del Cobre, Oriente, which at present is shut down, has been in operation since 1830. The mineral occurs in tuff intruded by andesite dikes, the mineralizing agents.

This sierra and the Sierra Maestra, largely made up of diorites, syenites, granites, and limestones, occupy the southern portion of Oriente, extending to the sea. Many outcrops and several interesting prospects are found in these mountains. Among other more important factors which retard the proper exploration of them may be mentioned the relative inaccessibility of the whole region, a series obstacle for small mining enterprises.

The known copper showings in the northern part of Oriente, Camaguey, Matanzas, and Havana provinces, all in basic rocks and in many occurrences of magmatic origin, are less attractive, but they are nevertheless worthy of investigation. As a type of this kind of mineralization, consideration may well be given to the zones of Canasí (Havana) and Cárdenas (Mantazas). Here are found tabular bodies of red oxide of copper, originally magmatic segregations of sulphides, ranging from over a few feet to over 100 ft. long (Canasí), and from a few inches to a few feet in thickness. The surface being an accidental section through these masses of serpentinized rocks, it is logical to assume, in view of the genetic relations of these orebodies, that many more lie in depth scattered through the serpentine; furthermore, that small amounts of copper may be thoroughly disseminated throughout the serpentine. The latter seems to have been proven at Canasí, where analyses of country rock chosen at random in crosscuts in a prospect have shown about 1 per cent copper, and where a small tabular orebody was found in a small shaft sunk near a rather large outcrop. The existence, therefore, of important low-grade deposits readily suggests itself.

The Province of Pinar del Río has become noted in Cuba as a cupriferous territory through the discovery the exceptionally rich Matahambre mine nine years ago and through the prospecting that followed. The ore at this mine has the appearance of a breccia, in which chalcopyrite is the material cementing fragments of slate from the shattered country rock along a fault. This cementation occurred simultaneously with considerable replacement. Similar conditions obtain in many other localities among the hills of this province; but instead of chalcopyrite predominating in these other deposits, the mineralization consists almost exclusively of an intimate mixture of cubanite and pyrite, not susceptible of mechanical concentration beyond perhaps 8 per cent, and requiring the application of metallurgy to make them pay under present conditions. Matahambre ore concentrates to about 22 per cent copper besides yielding whole cargoes of shipping ore assaying 20 per cent and over of copper.

Besides this type of ore formation, there are occurrances of magmatic segregation both in lenses and porphyritically in diorites at La Palma, and again in lenses ten miles inland from La Esperanza, especially in the neighborhood of La Constancia mine.

Pyrites, Lead, Silver, Gold, and Other Minerals Found

Iron pyrites is abundant in the provinces of Pinar del Río, Havana, Matanzas, and Santa Clara, where the Davison Sulphur & Phosphate Co. is developing an important deposit in the mountains north of Cienfuegos, which occurs in metamorphosed limestones in the vicinity of basic intrusions, the mine being equipped for an output of 500 tons per day.

Occurrences of argentiferous lead are found in Pinar del Río and Oriente, as well as of barytes; also of blende in Oriente. Graphite and silver-bearing antimony are found in Havana (Isle of Pines). Argentite and other silver minerals are reported from a certain locality near Bayamo, Oriente, and gold has been mined intermittently for many years in this province, near Holguín, from parallel veins about 2 ft. thick which are said to run $10 per ton. Auriferous quartz veins occur near Trinidad, Santa Clara. Light gray marble is being quarried at the Isle of Pines, and colored marble occurs at various places in Pinar del Río.

Indications of Petroleum Widespread

Gas emanations, oil seepages, pitchpools, asphalt veins and deposits are relatively common occurrences. Nearly all of these showings are found north of the main axis of the country from one end to the other, assuming greater frequency and abundance in certain localities, as, for instance, in the Province of Matanzas. Both foreign and Cuban capital, but mainly the latter, has been engaged in drilling the last eight years, and most of the work has been done in Havana, where about forty wells have been drilled; three wells have been put down in Matanzas, four in Pinar del Río, and six in Santa Clara.

Efforts to find oil in Cuba were made twenty and even forty years ago, but on a much smaller scale. Geologic conditions have been generally ignored. A good deal of the drilling has taken place in serpentine, following surface indications and keeping close to centers of population. Secondary deposits have thus been found in igneous rocks, as at Bacuranao, Havana, and Motembo, Santa Clara. At the former place 100,000 bbl. of 25-deg. Bé. asphalt-base oil has been obtained in the last few years from wells drilled in ten acres of ground, from a depth of 1,000 ft. In the gas region of Motembo, where six wells have been drilled, a secondary deposit consisting of 64-deg. Bé. naphtha has been discovered at depths between 675 and 1,200 ft. This product is colorless, transparent, and scented. About 100,000 gal. has been marketed so far for use in place of gasoline. Only showings of oil have been found in Pinar del Río, and small amounts so far of 28-deg. Bé. oil, rich in lubricants have been found at Cantel and of heavy oil at Sabanilla, both in Matanzas and about 50 km. apart.

Cuban asphalt is usually of high grade. It has been worked at various times in a desultory fashion in Pinar del Río, Havana, Matanzas, and Santa Clara, the most important work having been done in the first and last mentioned provinces by an English and a Cuban concern respectively. The only work done at present is at Mariel, Pinar del Río. Great quantities of high-grade asphalt are found at the bay of Cárdenas.

Opinions vary greatly as to the possibility of discovering important oil deposits in Cuba. It may be said that whatever results have been obtained have been due entirely to wildcatting. The larger oil companies have occasionally sent men in the last eight years to study geologic conditions, and it may be said that only recently has any real interest been shown, a supposed subsidiary of the Standard Oil Co. having started drilling operations at Taco-Taco, Pinar del Río. The first well is down 3,000 ft., and it is said it will be carried to a depth of 4,000 ft.

The belief that eventually commercial deposits will be discovered is gradually gaining acceptance, and as indications have been found over an area of 8,000 square miles, it is logical to assume that the right conditions for the accumulation of oil are bound to prevail somewhere within that territory.

USEFUL OPERATING IDEAS

Assay of By-Products of Gold Reduction Works

BY JOHN WATSON

White Precipitate or Hydrates. This material forms in the extractor boxes, very often, where gold is being precipitated from solution by zinc. Its composition varies considerably at different mines under varying conditions. In some cases, it is composed largely of zinc hydroxide, $ZnOH_2$ with zinc cyanide. On the City and Surburban mine, about twelve years ago, I found a cream-colored precipitate, from the sand extractor boxes, to contain 53.47 per cent magnesium carbonate; 15.36 per cent calcium carbonate, and 11.93 per cent zinc hydrate. Recently samples from the East and West Rand have been found to contain 38 per cent and 39 per cent, respectively, of silica, in a very fine state of division. The material should be thoroughly dried, pulverized to pass through a mesh of 100 holes per linear inch, then thoroughly mixed, average samples taken and sealed. Where the precipitate is being sold to smelting works the sampling is done in presence of the vendor's representative.

For assay, three portions each of .50 A.T. may be taken, and the average of the three results reported. The following flux gives, as a rule, good results:

Dry sodium monocarbonate	.50 A. T.	Litharge	1.50 A. T.
Silica (which must be free from gold or silver	.50 A. T.	Maize-meal or charcoal	.10 A. T.
Borax (anhydrous)	.50 A. T.	Sample	.50 A. T.

After grinding intimately together, in a Wedgwood mortar, fuse in fire-clay crucible, of ample size, until the fusion is complete and the melt quiescent, when the hot liquid contents are poured into slag-moulds. Cupellation of the lead-buttons and weighing of the bullion beads are next carried out in the ordinary way. Reinquart with pure assay silver foil, adding 2½ times the weight of silver to the weight of gold present. The silvery beads are then flattened on a small steel anvil, parted in dilute pure nitric acid of 1.21 sp. gr., (1 acid : 1 distilled water), which should be boiling, or nearly so, when the bead is introduced. In the case of very rich samples and large beads, a further boiling in hot stronger nitric acid (1.31 sp.gr.), until action ceases, may be necessary. Then decant, wash well with hot distilled water, anneal in cups or porcelain crucibles and weigh. The following show results of assays of this material.

Sample	Vendor Oz.	Buyer Oz.	Arbitration Assay Oz.
A	63.00	72.80	73.67
B	183.40	160.60	167.20
C	505.60	540.60	550.93

The silver contents of this material vary on the Rand, from about 12 oz. up to 72 oz., or more, per ton.

Concentrates. These may be assayed by using a somewhat similar flux to the above; but, it is advisable to increase the litharge to 2.50 A. T., the other constituents being weighed out as given above. Typical results of concentrate values are as follows:

Consignment	Vendor Oz.	Buyer Oz.	Arbitration Assay Oz.
A	13.40	11.80	13.17
B	11.50	12.30	11.98
C	25.62	23.90	25.63

The proportion of silver in the gold bullion averages about 10 per cent on the Rand, though it varies somewhat in different districts.

Pan-Furnace or Borax Slag. Both the Tavener furnace and "pot-smelting," (in a reverberatory furnace), are in use on the Rand. The slag obtained is used over again, in some cases; but, in time, becomes refractory or so rich in gold that it is sold to a smelting works. The following flux is suitable, as a general rule, for this material:

Dry sodium carbonate	.50 A. T.	Litharge	1.00 A. T.
Borax (anhydrous)	.35 A. T.	Maize-meal or charcoal	.10 A. T.
Silica	.35 A. T.	Sample	.50 A. T.

Typical assay results, of this material, are as follow:

Lot	Vendor Oz.	Buyer Oz.	Arbitration Assay Oz.
A	8.67	7.30	8.02
B	1.70	2.00	1.77
C	38.20	35.20	35.10

This material may contain as much silver as fine gold. Indeed, I have known a case where the silver content was about fifteen times more than the fine gold present.

ASSAY OF OLD GRAPHITE CRUCIBLES

In April, 1911, I read a paper on the assay of old plumbago pots (see *Jour. Chem., Met. and Min. Soc. of So. Afr.*, Vol. XI, p. 462 *et sq.*), describing a method of assay. In the discussion which followed, about six or seven other methods were described. This material has proved difficult, in the past, to young or inexperienced assayers.

In preparing the sample, it should be pulverized fine enough to pass through a sieve of at least 90 holes per linear inch and should be thoroughly mixed. Where such pots (or crucibles) have been used for cyanide gold, the product is, as a rule, brittle; but with mill-gold, malleable "metallics" may be present and should be weighed and treated separately. In the case of a rich sample, three portions should be weighed out of .20 A. T. each. If the material is poor, portions of .50 A. T. may be worked upon. In the former case, the following flux will be found to give, as a rule, good results, viz: Dry sodium monocarbonate, .50 A. T.; borax (anhydrous), .25 A. T.; silica, .50 A. T.; red lead, 2.00 A. T. The flux and sample-portion, after weighing out, are mixed intimately in a Wedgwood mortar by grinding and transferred to a fire-clay crucible of ample size If .50 A. T. portions of the sample are worked on, the flux is, of course, increased proportionately. Heat gradually, at first, and fuse till the whole charge is quiescent and a good melt obtained. About twenty minutes at a bright red heat is usually sufficient. Keep the slag from each portion, (after separating from the lead button), return to its original pot and re-melt, adding a little litharge and charcoal (mixture) to act as a "wash." These leads may be

cupelled, separately, to show what gold is present in the slag. The following results show variations in such material, in actual cases:

Sample	Vendor Oz.	Buyer Oz.	Arbitration Assay Oz.
A	22.85	14.50	23.92
B	43.40	28.40	49.75
C	3.70	3.00	3.71

In some cases, old plumbago pots, ground, are used as a bed beneath the firebrick lining of the Tavener or pan-furnace. In this case, the material may become still further enriched in gold contents. I have known such material to assay 130 oz. fine gold per ton. When such material is sent as "old brick" to smelting works, the assayer should be notified of its presence, as old plumbago crucible requires special treatment, as above.

Protecting Knife Switches

BY ROY H. POSTON

Where exposed knife switches are used, short circuits caused by a "short" across the live poles may be avoided by the use of a block of fiber fastened to the switch base and inclosing the switch points and projecting above them for an inch or so. Holes are cut in the fiber to admit the switch points. Slots should also be cut to permit the switch to be closed.

Treating Surface Residues for Gold

A large quantity of ore, formerly considered worthless, is awaiting treatment on the surface of some of the old mines on the Rand. Radical departure from routine has resulted in the development of a method for treating this material at a profit, according to the *South African Mining and Engineering Journal*, which gives the following account of the process employed at the old May Consolidated mine:

This mine was once a high-grade proposition, and its outcrop ore averaged over an ounce recovery. In due course it exhausted more or less its claim area, and finally dropped out of the running as an independent producer, becoming merged in the mines on its dip. The known richness of its ore led many people to attempt the treatment of the surface stuff, and all were fairly successful in making a profit from their work. Previous to the present owner taking over the property no fewer than three previous owners had treated the ground with satisfactory results, and it was reasonably assumed that ground so treated could not be made to give profitable results for the fourth time. This is, however, exactly what has happened in the present instance. Incredible as it may appear, the actual recovery value of the ore now being treated is 7½ dwt. out of a total estimated value of 10 dwt. per ton.

The plant consists of a four-stamp mill, Natal type, each stamp weighing 650 lb. The ground is collected by boys and brought to the mill, where it is dumped and fed into the mortar-box in the usual way. No amalgamation plates are used anywhere. After leaving the mortar-box the pulp is run along a short length of launder to a table, over which it passes, and from thence through another launder and again over a second table. On its way it leaves behind it the heavy material in the form of concentrates, and the residue falls into a sump and after draining is deposited in heaps wherever convenient. The tables are built up in sections on a frame. They are made chiefly of flooring boards with slightly turned-up edges and are covered with ordinary gunny sacks, that is, mealie bags, to which the concentrates adhere. These sectional parts are removable at will, and two boys deal with them as often as they need attention, as follows: after removal from the framework on which they lie they are carried to a tank and water is soused over them to remove their contents, which latter sink to the bottom of the tank and in due course are removed, bagged and sent to the sand-smelting works for final treatment. The average value of the ground before milling is 10 dwt.; the average value of the residues after treatment is 1½ dwt., showing a recovery value of 7½ dwt. per ton or 75 per cent. The whole secret of success lies in the concentrating tables. The idea is novel and is the subject of an application for patent rights by the inventor. Its *raison d'etre* is somewhat as follows: An iron framework is first made of ordinary 2 x 2-in. angle-iron bars, so erected as to resemble when constructed nothing more than a small electric power standard. This is laid down sideways so that the difference in height between the bottom and the top of the framework represents the grade of fall for the flowing pulp. This framework rests in turn on two ¾-in. round steel bars fixed transversely to the slope of the framework; four small wheels, two at each end of the frame, form the connecting link between it and the bars. It will be seen then that the framework has a longitudinal movement only along the steel bars by means of the small wheels. Movement is imparted to the framework by means of two connecting rods fixed to it at one end and at the other end to a small wheel fixed on to line shafting carried from the mill. The whole of the plant is run by a Crossley high-speed paraffin engine, which gives excellent results on a very low average oil consumption. It is particularly claimed for this invention that it recovers fine gold as well as coarse in the concentrates. Wilfley tables were originally tried here, but did not give good results in working as no fine gold was recoverable by this means. From what has been stated above regarding the nature of the ground to be treated, it is seen that the presence of impurities of many kinds made ordinary methods impracticable. If copper plates are used, the sulphuric acid and other impurities in the ore attack the plates. Coal scours the mercury and causes it to run off the plates. In the cyanide tanks coal and ashes prevent proper cyanidation of the gold, while the presence of acids adds to the disadvantages incurred. The ordinary methods of adding lime, etc., are useless to overcome the deleterious elements present, and consequently the routine of ordinary practice is inapplicable. All these things have been tried and have invariably failed to recover the gold.

The success of the new method is its own justification, and the fact that, no matter what the foreign elements in the ore treated, the recovery of the gold in the concentrates is sure, makes it especially applicable to the extraordinary conditions prevailing as regards these old deposits. It may be further pointed out that the gunny sack or mealie bag is preferable to blanketing or corduroy as a means of retaining the concentrate.

Haulage Facilities at Quincy Smelter

Concrete floors and rubber-tired trucks have been adopted for all haulage at the Quincy smelter, in northern Michigan, instead of steel rails and cars. The drier for the chemical laboratory is a simple plate warmer installed in a concrete safe.

THE PETROLEUM INDUSTRY

New Legislation Needed to Remedy Abuse by Standard Oil Monopoly

Federal Trade Commission Says Standard Interests Dominate Oil Business of the Country—Dissolution Under Sherman Law Is Not Effective

The Federal Trade Commission has sent to Congress a report on conditions in petroleum in Wyoming and Montana. This report summarizes the important facts developed through an inquiry into the conditions in those states made pursuant to a complaint of the Montana State Railway Commission regarding gasoline prices.

The margins, between the wholesale and retail gasoline prices at numerous points in Montana, ranged from 5 to 10c. per gallon, but these unusually large margins were in all cases obtained only by the smaller retailers. The wholesale and retail prices of the large marketing companies were usually identical at points taking the same freight rates, and changes in price were made by them at practically the same time. No evidence was found, however, which indicated a conspiracy among these large companies to fix prices.

Although the prices of high-grade crude petroleum were lower in Montana and Wyoming than in any other crude-producing states in the country, the refinery prices of gasoline and kerosene were much higher than at Mid-Continent refineries. The Midwest Refining Co. is owned by the Standard Oil Co. (Indiana) and produces more than 90 per cent of the gasoline and kerosene refined in the entire Rocky Mountain territory. The Midwest Refining Co. also charges higher prices for gasoline shipped into Montana and adjoining Rocky Mountain states than for shipments made in states adjacent to the Mid-Continent oil field.

The unsatisfactory situation in Montana and adjacent Rocky Mountain states is evidently due, says the report, to the fact that the oil trade in this region is practically monopolized by Standard Oil interests. The producer of crude petroleum and the consumer of gasoline are both at the mercy of the Standard. This monopolistic position was perfected in 1920 and 1921, when the Standard Oil Co. (Indiana) secured control of the Midwest Refining Co. and acquired a one-half interest in the Sinclair Pipe Line Co., and the Sinclair Crude Oil Purchasing Co. Sinclair interests have recently obtained important leases in the Teapot Dome of the Salt Creek field in Wyoming. Standard companies now dominate every branch of the petroleum business of the entire Rocky Mountain region.

The conditions in other sections of the country are not radically different from those in the Rocky Mountain region. Today the entire country is divided into eleven Standard gasoline marketing territories in which a Standard marketing company is the dominating factor and in which there is no real competition between the various Standard units. This monopolistic situation is possible under the terms of the Standard Oil dissolution decree, by which the different Standard companies are, for legal purposes, supposed to be strangers to each other, but, there is, as is generally known, an interlocking stock ownership in the different organizations which has perpetuated the very monopolistic control which the Court sought to terminate.

The Commission is of the opinion that this situation cannot be effectually remedied by existing laws and that adequate relief can only be secured through additional legislation. It recommends, therefore, that Congress pass a law prohibiting common stock ownership in corporations which have been members of a combination dissolved under the Sherman law.

Drill Runners in Oil Fields Averaged $1.14 Per Hour

The best paid employee in the oil industry in the United States is the drill runner. His wages during 1920 averaged $83.90, according to statistics just issued by the U. S. Department of Labor. The figures are based on a study of representative plants in the principle centres of the industry.

The customary hours of work at the wells and on the pipe lines ranged from eight to twelve per day and at the refineries from eight to thirteen. Forty-five per cent of the employees at wells, 43 per cent on pipe lines, and 65 per cent at refineries worked not more than eight hours per day; 76 per cent at wells, 77 per cent on pipe lines, and 96 per cent at refineries not more than nine hours; while 85 per cent at wells, 99 per cent on pipe lines, and 99 per cent at refineries worked not more than ten hours.

The accompanying table shows the average full-time hours per week and average earnings per hour in the leading occupations:

AVERAGE WAGES PAID IN OIL FIELDS

Occupation	Average full time hours per week	Average earnings per hour
WELLS		
Drillers	73.6	$1.140
Drillers' helpers and cleanout helpers	59.7	.683
Firemen	57.7	.651
Laborers, roustabouts and connection men	57.7	.589
Pumpers and engineers	62.5	.582
Tool dressers	78.6	.934
PIPE LINES		
Engineers and pumpers	57.2	.749
Firemen	55.7	.701
Gaugers, deliverymen, and oil receivers	58.9	.775
Laborers, roustabouts	54.7	.528
Line walkers	62.5	.584
Telegraph operators	56.0	.676
REFINERIES		
Engineers and chillermen	55.3	.811
Firemen and assistant engineers	53.6	.756
Pumpmen	53.6	.789
Stillmen	54.2	.905
Stillmen's assistants, chargers and headers-up	53.6	.799
Boilermakers	48.1	.991
Boilermakers' helpers	47.6	.741
Laborers	49.7	.575
Machinists	48.5	.905
Pipe fitters	49.4	.855
Pipe fitters' helpers	48.8	.685

New Books

Mine Fans and Ventilation

Practical Mine Ventilation. By J. R. Robinson. 5½ x 8½ in.; 225 pp. Published by J. R. Robinson, 6,027 Jenkins Arcade Building, Pittsburgh, Pa.

Mine ventilation has too often been treated from the point of view mainly of mine gases and of distribution of air, and the matter of production of air pressure has been left to the manufacturer. A few pretty pictures of fans have lightened the text of many former volumes on this subject, but the author, not being a fan expert, satisfied himself, or rather tried to rest satisfied, with the most meager details regarding the originating means for ventilation, notwithstanding, it is true, several pages on steam jets, furnaces and the trompe, which are wholly inadequate means of inducing an air current.

This book gives the fan its appropriate place without in any way being a catalogue of types. It supplies calculations in connection with the selection of fan size that will be of value to any reader who has to ventilate mines.

Interesting among his remarks are those on the correction of friction of air. Giving Atkinson's, Fairley's and Murgue's coefficients (k) as 0.0000000217, 0.00000001 and 0.000000009 respectively, Mr. Robinson adds: "These coefficients are the result of experience and are practical, but they can be used only by those who have a wide experience and knowledge of mining conditions. It will be observed that Atkinson's coefficient is nearly 2½ times Murgue's, and unless the engineer has a wide experience he does not know which coefficient to use on the particular mine that is the subject of the calculation. The author has had some mines come under his observation wherein the coefficient k=0.000000069 and others where the coefficient=0.000000006, the last figure being less than 10 per cent of the former. The coefficient k= 0.000000006 will apply to airshafts that are well lined."

The book clearly shows the disadvantage of having a fan ill-fitted to the mine conditions. This is an important subject, and little has been written about it. It is fully time to get books written by manufacturers of fans to supplement those the authors of which are mine engineers, professors and theorists. The point of view is one that cannot be neglected with safety. Too often the manufacturer of mine equipment fails to publish what he knows about the practical problems of the mine, and the industry is the loser.

Interesting statements are that excessive quantities of air absorb the moisture of mine surfaces and make the mine dangerous, that large cavities in the roof of roadways simply result in baffling the air, that regulators are a great source of power loss, that the use of auxiliary fans is preferable and that these "boosters," serve to lengthen the life of primary fans. The use of regulators, so to speak, lays a tax on the whole mine so as to protect and make possible the ventilation of a split that is unusually difficult to ventilate. It is better to aid the air through that split than to burden the whole mine with an excessive water gage for that purpose. Ventilation bills will be saved if this fact is given due consideration.

A most valuable table is provided by W. H. Hall, of Coalwood, W. Va. He shows the most economical size of shaft to deliver 100,000 to 600,000 cu.ft. of air by 100,000-cu.ft. increments. Thus 100,000 cu.ft. of air calls for a 10 x 10 ft. shaft; 200,000 cu.ft. a 14 x 14 ft. shaft; 300,000 cu.ft. a 16 x 16 ft. shaft; 400,000 cu.ft. an 18 x 18 ft. shaft; 500,000 cu.ft. a 20 x 20 ft. shaft and 600,000 cu.ft. a 22 x 22 ft. shaft. The depth of the shaft is taken as 100 ft., excavation is figured at $15 per cu.yd., concrete lining at $30 per cu.yd., life of mine at fifty years and power at 2c. per kilowatt hour.

In the case of the Federal Coal Co.'s mine at Grant Town, where it would have been necessary to use 11.87 in. of water gage to pass the 300,000 cu.ft. per minute needed in place of the 132,000 cu.ft. which 2.3 in. of water gage permitted to be passed, the management found a way to cut in an airway, and through this an air current circulated, reducing the pressure 25 per cent. Other practical instances are given where attention to ventilation has made great economies.

Mr. Robinson has allowed himself to be a little discursive. He has several pages on the mechanical and historic development of the coal industry from its earliest beginnings. The story is well told and exceedingly interesting, for the coal industry is the mother of the mechanical arts. The steam engine, the pump, the railroad, the locomotive, and the fan were built largely for her service and by her engineers. The only misfortune is that having done so well in earlier years, mining engineering has been willing of late to be boosted from outside instead of by the exercise of her own activity.

R. D. H.

The Iron Ore Resources of South Australia. By R. Lockhart Jack, Geological Survey of South Australia. Bull. No. 9. Pp. 71; 6 x 9¾ in.; several plans and charts. Adelaide, 1922.

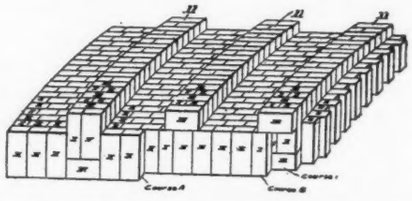
The chief uses of iron ores in South Australia are for steel making, for foundry pig, for flux in reducing lead and copper ores, for ocher and road materials. Production has been small, the highest ore output being about 500,000 tons in 1921. As the country is of wide extent and transportation facilities limited, many deposits are of no economic value at the present time. The most important deposit is the Iron Monarch with adjoining Iron Knob, having 133,000,000 tons of ore in sight. The next in importance is in the Middleback Range with an estimated tonnage of 33,000,000 in easily recoverable ore. The other deposits are of much smaller size, and are of doubtful value except for limited uses. The individual deposits are described in detail with plans and charts. The iron situation of the State is admirably presented in this report. O. B.

Petroleum Year Book, 1922. Published by the Petroleum World Publishing Co., Los Angeles. $5.

The primary purpose of the book is to serve as a directory for the petroleum industry in California. It is more than this, however, for statistics and miscellaneous data on the industry throughout the world are incorporated. There are listed about 1,700 companies that are either producers or lease holders in the California fields. The names of officials and sundry other data are given for each company. A number of general articles are included, and the book is well illustrated with portraits and other photographs.

Recent Patents

Reverberatory Roofs—No. 1,416,716. A. N. Jette, Anaconda, Mont. A method of building arched reverberatory roofs with ribs, as shown in the illustration.



Concentrator—No. 1,416,928. J. B. Arthur, by Mary B. Arthur, Joplin, Mo. A rotary concentrating table with means for revolving it and removing the concentrate and tailing.

Magnesium — Canadian patent No. 218,397. Leonard Waldo, Plainfield, N. J. The magnesium compound from which the metal is to be recovered is finely ground, mixed with finely ground metallic aluminum, and heated in a vacuum to from 1,100 to 1,350 deg. C., whereupon the magnesium is volatilized and may be condensed in the metallic form.

Aluminum — Canadian patent No. 218,326. Louis Burgess, Bayonne, N. J. Aluminum oxide, free carbon, and a pitchy material are mixed and heated to a sufficient temperature for coking. The mixture is then broken up and charged into an electric arc furnace.

Hydrometallurgy of Copper—Canadian patent No. 218,987. A. A. Lockwood, Mostyn Road, Merton Park, Surrey, England. Copper is leached from ore by suitable means, and deposited electrolytically, a jet of air being used in the electrolytic vessel to prevent sedimentation of the insoluble impurities.

SOCIETIES, ADDRESSES, AND REPORTS

French Government Honors Dwight and Rand

Bestows Cross of Legion of Honor for Distinguished Service During War —Exchange Professor Named

At a luncheon on July 20 which was attended by leaders in engineering from every section of the country, Col. Arthur S. Dwight, president of the American Institute of Mining and Metallurgical Engineers, and Charles F. Rand, chairman of the Engineering Foundation, were decorated with the Croix de Chevalier de la Legion d'Honneur by the French Government for distinguished service during the war.

The decorations were conferred by Consul General Gaston Liebert, at the Engineers Club, in New York. In a speech extolling the war work of the American engineer, Mr. Liebert declared that Germany had been definitely foiled in her attempt to cripple France industrially for a generation by wrecking the coal mines of northern France. Three-fourths of these mines, he said, were in full working order and the remainder will be in complete operation within two years. The Germans, he declared, thought that it would take from fifteen to twenty years to do this.

Calvin W. Rice, secretary of the American Society of Mechanical Engineers, who presided, said that international unity among engineers was the dream of Andrew Carnegie, who saw in the efforts of the engineer and the scientist the hope of civilization. Mr. Rice announced that Dr. M. E. de Margerie, Director of the Geological Service of France, has been appointed French exchange professor to America in applied science and engineering. The American exchange professor under this arrangement is Dean John Frazer, of the University of Pennsylvania, who is now in Paris.

Dr. de Margerie, who has visited America three times, will lecture on applied geology, especially as applied to topography, in seven American universities during 1922-1923, opening probably at Columbia. Other institutions participating in this exchange plan are Cornell, Harvard, Johns Hopkins, Yale, University of Pennsylvania, and the Massachusetts Institute of Technology.

In presenting the decorations, Consul General Liebert eulogized Col. Dwight and Mr. Rand as personifying the spirit and service of the American engineer, which, he asserted, was a powerful factor in the victory over Germany. There was a growing friendliness, he said, between the United States and France. The two countries, he declared, had come to understand each other better since the Genoa and the Hague conferences. The general Franco-American situation, he thought, had greatly improved since the Disarmament Conference in Washington.

The ceremony he described as an epoch in international relations. Mr. Liebert said that reconstruction was going on rapidly in northern France, two-thirds of whose industries were now working. The French Government, he said, was planning water power improvement on a vast scale, and that as a result it would soon be unnecessary for France to import a single ton of coal. He urged that French students be sent to America to study engineering.

Both Col. Dwight and Mr. Rand have previously been honored by foreign governments. Col. Dwight as major aided in recruiting and training the Eleventh Engineers, the first unit of the A.E.F. in action. He served twenty-two months overseas, receiving the D.S.O. from the British, and being cited by General Pershing.

In 1913, Mr. Rand was decorated by King Alfonso of Spain with the Grand Cross of Knight Commander of the Order of Isabella Catolica for distinguished services to Spain and to mining. Mr. Rand is a director and past president of the American Institute of Mining and Metallurgical Engineers and as the head of the Engineering Foundation is active in promoting industrial research in America.

Guests at the luncheon included William Young Westervelt, John H. Dunlap, Robert Linton, William McClellan, J. Parke Channing, John R. Freeman, F. L. Hutchinson, George D. Barron, W. M. Corse, J. V. W. Reynders, Arthur W. Berresford, W. H. Aldridge, Nelson P. Lewis, Calvin W. Rice, Edward D. Adams, J. W. Lieb, James T. Grady, C. R. Corning, G. S. Webster, W. R. Ingalls, Percy E. Barbour, Frederick F. Sharpless, R. L. Lloyd, J. E. Spurr, Robert A. Cummings, Dean Mortimer E. Cooley, L. W. Wallace, R. Prouin, Allen H. Rogers, C. O. Mailloux, Galen H. Clevenger, Dr. A. H. Ledoux, and Comfort A. Adams.

Harvard, Yale, Columbia, Massachusetts Institute of Technology and other universities and technical schools were represented. Several radio messages from France and Italy were read, among them one from the president of the Italian Senate and another from the National Association of Italian Engineers. A third message from the engineers of Italy thanked the John Fritz Medal Board honoring Senator Marconi and pledging Italian engineering aid in a general plan of world unity.

F. A. E. S. Committee Appeals to President Harding

Asks Protection for German Patents Sold to Chemical Foundation— Audience Sought by Society

Engineers have appealed to President Harding to protect patents sold to America, it was announced by Dean Mortimer E. Cooley, of the University of Michigan, president of the Federated American Engineering Societies. The appeal is contained in a resolution adopted at a meeting in New York on July 14 of the Federation's Committee on Procedure, of which Calvert Townley, vice-president of the Westinghouse company, is chairman.

The resolution, sent by Executive Secretary L. W. Wallace to President Harding, says that the patents formerly owned by Germany and her allies, and, through the Alien Property Custodian, ordered returned from the Chemical Foundation, "have become the nucleus of our American synthetic organic chemical industry which must be encouraged for the sake of scientific research, public welfare and national defence."

"The Federated American Engineering Societies, through its Committee on Procedure," the resolution continues, "expresses the hope that no action will be taken without hearing representatives of chemists, chemical engineers, chemical manufacturers, the medical profession and others most directly concerned and implores that nothing be done which can, in any way or to the slightest extent, tend toward the ultimate return to former owners, of patents or other property, lawfully sequestered and sold to Americans.

"It is of importance to note that the Federated American Engineering Societies speaks concerning national problems for thirty-odd national, state and local engineering societies. The federation, therefore, speaks on behalf of some 55,000 engineers."

The Federation's Committee on Procedure includes Dean Dexter S. Kimball, of Cornell University, J. Parke Channing, of New York, William McClellan, of Philadelphia, and William E. Rolfe, of St. Louis.

So that the President might have the advantage of the views of a group of prominent men interested in the promotion of chemistry as a science, the American Chemical Society on July 12 sought an interview with the President for a committee which had been named. Up to the time of writing, no appointment had been made. Attention was called to the fact that the interest of the American Chemical Society is dif-

ferent from that of the manufacturing chemist.

If the committee is granted an interview it is the intention of its members to tell the President that, so far as they have been able to learn, the purposes of the Chemical Foundation are laudable and that it has been conducted without irregularities. He will be advised that a representative of the committee listened to a two-hour explanation of the position of the Department of Justice without having elicited any information as to illegal conduct on the part of the Foundation. In view of those facts, President Harding will be asked if he has any information which he can impart to them, in confidence if necessary, which would indicate the society is wrong in placing its support behind the Chemical Foundation. The members of the committee will tell the President that, in the light of all the information they have been able to gather, they can see no reason for this blow dealt to research.

A. I. M. E. Members Plan Special Trip to San Francisco Meeting

A sightseeing party, including President and Mrs. Arthur S. Dwight and other members of the A. I. M. E. who are going to San Francisco for the annual meeting of the Institute, will be made up in the East on Sept. 9, and will pass through the middle western and northwestern states, where, it is hoped, it will be joined by the members from these states. The party will arrive in San Francisco on Sept. 24, returning to New York after the meeting by way of Los Angeles and the southwestern states. Stops will be made at several of the interesting mining centers upon invitation of the local sections.

The trip out will include an automobile drive through the Denver Mountain Parks and a trip through the Royal Gorge and over the Tennessee Pass. At Salt Lake City various mines and smelters will be visited. One afternoon will be spent at Kellogg, Idaho, at the plant of the Bunker Hill and Sullivan company.

On the return trip, the party will visit the mines and mills near Kingman, Ariz., and will spend a day at the Grand Canyon. The members will make the journey by automobile to Roosevelt Dam and over the Apache Trail. It is planned to reach New York on Oct. 11 on the return.

What the cost of the trip will be will remain in some doubt until the number joining it is positively known and until the traveling accommodations that will be required have been determined. It may be stated now, however, that it will not be less than $594 and not more than $873.50 per person. This will cover transportation, Pullman, hotel and most of the meals while en route. Requests for reservations should be sent before Aug. 15 direct to the Secretary, in New York City, with a remittance of $50 for each person, as a deposit on account.

MEN YOU SHOULD KNOW ABOUT

A. H. Collbran, of Korea, is in San Francisco.

A. C. Spencer has returned to Washington after a western trip.

C. B. Croner is doing special metallurgical work at Gray, Idaho.

Professor E. A. Hersam began his work on the drill steel problem at Boston on July 15.

A. P. Miles, of the International Nickel Co., is visiting the Kirkland Lake gold field, in Ontario.

Dr. R. B. Moore, chief technologist of the Bureau of Mines, has returned from a business visit to Europe.

A. J. Bone, of New York, has been inspecting several mining properties in the northern Manitoba mineral belt.

Frank H. Ahier has been appointed mines superintendent for the Shropshire Mines, Ltd., at Minsterley, Salop, England.

W. G. Mather, president, and several of the directors of the Cleveland-Cliffs Iron Co., are looking over the company's holdings in the Lake Superior district.

J. H. Hensley has been made superintendent of the Hiddenite Crushed Stone Co., at Hiddenite, N. C. He was formerly with the Southern Spar & Mica Co.

James Irving, of James Irving & Co., Los Angeles, has recently returned from Milford, Utah, where he made an examination of the Humboldt and Bohn properties.

George Milliron, formerly general superintendent with the Pittsburg Limestone Co., has been appointed superintendent of the Kittanning Limestone Co., at Kittanning, Pa.

George H. Garrey, who has been absent for some five months upon geological examination work in Nevada, California, Arizona and New Mexico, has returned to Philadelphia.

J. A. Bancroft, who resigned the chair of metallurgy in McGill University, Montreal, a year ago, to take a position with the Granby Consolidated Mining, Smelting & Power Co., will return to McGill in the fall.

Lewis W. Newman, general manager and secretary of the Great Northern Iron Ore Properties, at St. Paul, Minn., was a recent visitor on the Mesabi iron range, where he made a tour of inspection of the company's properties.

R. F. Murrill and **George H. Borth**, engineers of the Inspiration Consolidated Copper Co., have been visiting the Lake Superior mining districts looking for time-saving devices to use in a new shaft which their company is to sink.

The Bureau of Mines, at Washington, has appointed an advisory committee of Nevada mining men to act with the Rare and Precious Metals Station of the Bureau at Reno, Nev. Members are as follows: **John G. Kirchen**, of Tonopah; **Frank M. Manson**, of Reno; **R. A. Hardy**, of Gold Hill; **C. B. Lakenan**, of McGill; **E. A. Julian**, of San Francisco; and **Governor Emmet D. Boyle**, of Reno.

R. S. Beall has been put in charge of the zinc oxide plant of the Empire Zinc Co., at Canon City, Colo., which has recently resumed operations.

The address of **George Reed**, assayer and smelterman, who is a graduate of the University of California, and who has worked in Guatemala, Idaho, Colorado, Mexico and California, is desired by Herbert Lang, 2637 Shattuck Ave., Berkeley, Cal.

Charles E. Bunnell is to be president of the Alaska Agriculture College and School of Mines, located four miles from Fairbanks, which will open this September. **Earl R. Pilgrim**, now metallurgist at the Kirk-Simon Smelting Co., at Harbor City, Cal., will be head of the department of mining and metallurgy, and **Ernest N. Patty**, manager of the Gorrien Zinc Mines, near Northport, Wash., will be head of the department of geology.

J. E. Spurr, **George Otis Smith**, **Edward B. Mathews**, **R. A. F. Penrose, Jr.**, and **Horace V. Winchell** have been designated to be delegates on the part of the United States to the Thirteenth International Geological Congress to be held at Brussels, Aug. 10 to 19, 1922. **Herbert Hoover** has been appointed an honorary member of the delegation, but, due to the strike situation, he will not be able to make the trip. As Mr. Smith is also prevented from attending, **David White** will take his place.

OBITUARY

E. M. Grenier, traveling auditor for the American Smelting & Refining Co., at Denver, Colo., died at Henryetta, Okla., on July 6.

Reginald P. Rowe, one of the organizers of the National Lead Co., died suddenly on July 17 at his home in Brooklyn. Mr. Rowe was seventy-three years old. He was born in the Barbadoes, West Indies, and came to this country when fourteen years old. He was graduated from Danbury Institute and the Trinity School and was awarded a scholarship at Columbia University. Mr. Rowe was vice president and a director of the Baker Castor Oil Co., was a director of the Magnus Co., and was vice president and a director of the Matheson Lead Co. In addition to holding a similar position with the National Lead Co., he was vice president and a director of the United Lead Co.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Leading Events

CONSTRUCTION work on the reclamation plant at Torch Lake has been resumed by the Calumet & Hecla company in the Michigan Copper Country.

California's gold production for the first half of 1922 exceeded that of the corresponding period of 1921 by a good margin.

The newly discovered bonanza ore deposit in the Portland Mine at Cripple Creek, Col., is developing into a large one.

The coal and rail strikes have failed thus far to curtail production on the Michigan iron ranges, but serious concern is displayed by the operators in Minnesota, principally because of interference with transportation.

Union Miniere, from its mines in the Belgian Congo, produced more copper than any other company during 1921. The ore reserves are reported to be immense.

Senator King urges the Senate to adopt legislation looking to the stabilization of the silver market.

The zinc-oxide plant of the Empire Zinc Co. at Canon City, Col. has resumed operation.

The Dome Mines, Ltd., in Ontario has exceeded its former production record by milling $12 ore.

Officials of the American Brass Co. have visited the mines, mills, and smelters of the Anaconda Copper Mining Co. in Montana.

The proposed duty on arsenic and arsenic compounds is opposed by Senators from southern states.

Calumet & Hecla Resumes Construction of Torch Lake Re-treatment Plant

Work has been resumed on the construction of the reclamation plant on the Tamarack conglomerate sands, Torch Lake. Calumet & Hecla will push the project although its completion will not be possible before the spring of 1924. The plant will be designed to treat 850,000 tons per year, as compared with a maximum capacity of 1,500,000 tons for the Calumet & Hecla plant. There is approximately 12,000,000 tons in the Tamarack deposit, which averages by assay 12½ lb. of copper to the ton, 10 lb. of which can be reclaimed. Costs under normal conditions are from 4½ to 5c. per lb. The four processes used in reclamation are regrinding of the coarser sands, washing, leaching and flotation. The leaching and flotation buildings will be practically one. The foundations are already in.

Day Mines in Coeur d'Alenes Will Ship to A. S. & R. Plant at Helena

A long-term contract has been signed under which the entire output of the Tamarack & Custer and Hercules mines, in the Coeur d'Alene district of Idaho, will be shipped to the lead smelter of the American Smelting & Refining Co. at East Helena, Mont. These properties are known as the Day mines, and have hitherto sent their ore to the Day smelter at Northport, Wash. The A. S. & R. Co. will dismantle the plant at Northport, which it has acquired in the alliance with the Day interests.

Non-Metallic Mineral Producers Protest Withdrawal of Appropriations

Importance of the Industries Warrants Financing the Investigative Work Projected by the U. S. Bureau of Mines, They Say.

No other branch of the mining industry is so in need of research, statistics, and various types of economic surveys than is that involving the production of the "non-metallics." This deduction is drawn from the numerous letters which are reaching various agencies of the Federal Government, asking that this industry be accorded the same consideration as is given agricultural products and certain other mineral products. The Committee on Appropriations eliminated from the Appropriation bill, which became effective July 1, all funds for the continuance of the non-metallic work which was done during the last fiscal year by the Bureau of Mines. This seems to have aroused the producers of non-metallics more than ever has been the case before. In their letters to Washington, they point out that while the total output of the non-metals is valued at hundreds of millions of dollars, production is the aggregate of a large number of small operations. An industry so made up, it is contended, is in greater need of Governmental assistance than is one carried on largely by highly organized companies. It is urged that some action be taken to assure the continuation of the excellent work that has been undertaken by the Bureau.

Coal and Rail Strikes Fail to Affect Michigan Iron-Ore Production

The coal and rail strikes thus far have not interfered with mining or shipping operations on the Michigan iron ranges. Most of the mines use very little coal, relying on hydro-electric power, and those that do not are supplied for the immediate future. There are several large water-power developments on the Marquette and Menominee ranges, all of the Cleveland-Cliffs Iron Co.'s. properties being supplied from stations on the Dead and Carp Rivers. An independent company supplies most of the Menominee range mines with current. Some vessels have been retired temporarily from the lake trade, due to a shortage of coal, but it is believed that the July shipments will be equal to the June movement, which was close to 7,000,000 tons. Long continuation of the strikes will of course alter the situation.

Dome Mines Milling $12 Ore and Breaking Production Record

During the first six months of the present year the output of the Dome Mines at Porcupine, Ont., amounted to $1,973,000, as compared with $939,000 for the corresponding period of 1921. The grade of ore is running between $11 and $12, as compared with about $7 in the previous year. The June output of $351,500 constitutes a record and it is understood that profits for the first six months are in the neighborhood of $1,000,000.

Mining Companies Take Suit Involving Minnesota Occupational Tax to U. S. Court of Appeals

Permission has been granted the iron mining companies in Minnesota, who are fighting the Occupational Tax Law passed in 1921 by the State Legislature, to appeal from the decision of the Federal Court in favor of the Minnesota Tax Commission. It is the intention of the plaintiffs to take the case to the United States Court of Appeals and, it is intimated, to the Supreme Court, if necessary.

On granting this appeal the court continues the temporary restraining order which prohibits the placing of the state tax in effect pending further hearings, while a total of $1,300,000 is provided for agreements protecting the State in the event the appeal is lost. The mining companies claim assignment of error on the part of the court by holding that the business of mining is apart from the selling and transportation of ore and that the mining business may be made subject to a business or occupational tax. The plaintiffs further claim that the tax interferes with interstate commerce, to which the court did not agree in his decree, and this fact is included in the assignment of error. The present appeal will ask for a decree permanently enjoining the State Tax Commission from enforcing the occupational tax.

Cheaper Cyanide for Western Mining Companies

Deciding the complaint of the American Cyanamid Co., the Interstate Commerce Commission holds that the rates on cyanamid from Suspension Bridge, N. Y., and Niagara Falls, Ontario, Canada, to San Francisco, Los Angeles, and other Pacific coast destinations are unreasonable. It prescribes, effective Sept. 6, a reasonable factor beyond St. Louis, which shall not exceed 81.5c. per 100lb.

Boston & Montana Finances Adjusted, Says Butte Dispatch

An announcement has been made in Butte, Mont., by W. R. Allen, of Boston, president of the Boston & Montana Development Co., to the effect that operations have been resumed at the Elkhorn property of the company with two shifts of miners at work. Within thirty days the mill will be restarted, Mr. Allen said. He announced that all financial obligations against the company had been adjusted and that the company would be able to resume production at once. He said that he had made a thorough investigation of the mine and that in his opinion there was a better showing of ore than at any time since the company was organized. He does not attempt to say how much ore is in sight nor at what grade the mill heads are to be maintained.

Subsidy to Mount Morgan Gold Mining Co. To Be Continued

By Cable from Reuters to "Engineering and Mining Journal-Press."

Brisbane, July 18.—The Queensland Government has extended indefinitely the subsidy of £1,100 weekly to the Mount Morgan Gold Mining Co.

Operations at Broken Hill Resumed

By Cable from Reuters to "Engineering and Mining Journal-Press."

Broken Hill, N. S. W., July 18.—After three weeks idleness operations have been resumed at the mine of the British Broken Hill Proprietary Co., where 740 men have been re-engaged.

Metal Tariff Schedule Will Yield $18,016,578 per Annum

Senator Watson of Indiana estimates that during the first year of its operation the metal schedule of the new tariff bill will yield the Government $18,016,578 in revenue.

Empire Zinc Co. Starts Zinc-Oxide Retorts at Canon City, Col.

Operations have been resumed at the zinc-oxide plant of the Empire Zinc Co. at Canon City, Colo., which has been shut down for the past two years. One unit of the plant employing about fifty men has been started to date. The oxide plant is one of the largest in the West and accumulated a large surplus of finished product following the war but finally suspended operations pending disposal of the output. Improved markets for the product has lead to a decrease in stock on hand and the company announces that operations will be increased as fast as conditions warrant. R. S. Beall will be in charge of the Canon City plant.

Proposed Duty on Arsenic Attacked in Senate

Charges that the proposed duty of 2c. per lb on arsenic adopted by the Senate in the revised tariff bill will subject the cotton growers of the South to a tax of $18,000,000, were made in a Senate debate on the cotton schedule by Senator Smith of South Carolina. Senator Robinson, of Arkansas, also opposed the duty on the same score, while Senator Smoot, of Utah, for the Finance Committee, denied that the duty would impose such a tax. He said that based on last year's imports the duty would not exceed $100,000. It was also alleged that the schedule was the result of lobbying by the smelter interests, who produce compounds of arsenic as a by-product in the smelting of lead ores, and that, until the Department of Agriculture had found that arsenic was required to combat the boll-weevil, no duty had ever been suggested. Former schedules contained no duty on arsenic and its salts.

American Brass Officials Get First "Close-Up" of Butte Mines

President Kelley of Anaconda Prophesies that Operations Twenty Years Hence Will Be in Newly Acquired Territory

Officials of the American Brass Co., who are making their first visit to Butte since the company was acquired by the Anaconda Copper Mining Co., have made minute investigation of mines, smelters, and allied interests. They inspected the underground workings, went through all the departments of the smelters at Anaconda and Great Falls and also looked over the big plants of the Montana Power Co.

Announcement by John D. Ryan, chairman of the board of the Anaconda Copper Mining Co., that his company had decided to purchase a large number of claims adjoining A. C. M. properties west from Missoula gulch has aroused interest, but no further information has been forthcoming as to just what claims have been included in the deal. Mr. Ryan made the announcement at a dinner tended by the Butte Chamber of Commerce to himself and President C. F. Kelley, of the Anaconda company, and Charles F. Brooker, chairman of the board, and Joe A. Coe, president, of the American Brass Co.

It is known that one of the properties included in the deal is the Anselmo mine and it is presumed that practically all the territory surrounding that property will be taken in. The section, which has been worked successfully, is almost exclusively silver ground. According to Mr. Ryan, the properties which are to be taken over are those in which the Anaconda company has held a half interest for a number of years.

While Mr. Ryan and Mr. Kelley were showing the officials of the American Brass Co. around Butte, the visitors were taken to the western section of the city and, in the words of the Anaconda head, were told "Here is where we will be mining twenty or thirty years from now." It was the day after this remark was made that the announcement of the coming purchase of additional ground was made. The properties to be acquired are outside of Butte's present producing area.

Mr. Brooker made the statement that the merger of Anaconda and American Brass gave absolute assurance of the continued operations of Butte's copper and zinc properties to satisfy the demands of the company's manufacturing plants.

Nearly 60 Per Cent of Pittman Act Silver Has Been Purchased

Purchases of silver by the Bureau of the Mint during the week ended July 22, amounted to 200,000 oz. This brings the total purchases under the Pittman Act to 121,648,506 fine ounces.

News from Washington

By PAUL WOOTON
Special Correspondent

Two More War Minerals Claimants Get Relief

Subject to the approval of the Secretary of the Interior, the War Minerals Relief Commissioner has recommended an award of $3,740.62 in the manganese claim of Pruitt, Conway and McGlawn, of Atlanta. This is in addition to the previous award granted this company. Commissioner Robinson also recommended an award of $585 in the chrome claim of Thomas Bessler, Jr., of Sumpter, Oregon.

Disallowances were found as follows: John J. Sweeney, San Francisco, stimulation not established; W. P. Kendall, Sapulpa, Okla., commercial importance not established; J. E. Price, Seattle, stimulation not established; Daniel Merrifield, Grass Valley, Calif., stimulation not established; M. W. Mouat, Nye, Montana, no further award; S. E. Langford, Salt Lake City, Utah, commercial importance not established; John Henninger, Blythe, Calif., commercial importance not established.

Constituents, Seeking "Mineral Detectors," Pester Congressmen

That interest in metal mining is reviving may be judged by the volume of requests reaching the U. S. Geological Survey for information in regard to instruments useful in determining the presence of metalliferous deposits of which there is no evidence on the surface of the earth. Every member of Congress, it is said, has inquired from the Survey for a list of the manufacturers of such instruments.

Advisory Committee Will Assist Reno Officials of Bureau of Mines

So that the mining industry in the region tributary to the U. S. Bureau of Mines experiment station at Reno, Nevada, may have a voice in the conduct of the work an advisory committee has been named as follows: John G. Kirchen, Tonopah Extension Mining Co., Tonopah; Frank M. Manson, Western Ore Purchasing Co., Reno; R. A. Hardy, United Comstock Mining Co., Gold Hill; C. B. Lakenan, Nevada Consolidated Copper Co., McGill; E. A. Julian, Goldfield Consolidated Mines Co., San Francisco; and Emmet D. Boyle, Reno.

Overdevelopment of Domestic Coal Fields

According to Senator Gooding of Idaho, the United States produces 52 per cent of the world's coal. He quoted Ethelbert Stewart of the Bureau of Labor Statistics to the effect that the coal industry was overdeveloped. The report from Mr. Stewart referred to by the Senator in turn quoted F. S. Peabody of Chicago to the effect that the bituminous coal mines are capable of producing a billion tons of coal annually by working a full force and full time with present equipment and development. Mr. Stewart estimated our annual requirements of bituminous at 500,000,000 tons.

Senator King Advocates Congressional Action Aimed to Stabilize Silver

Consideration by Congress of legislation to stabilize silver was advocated by Senator King, of Utah, in a Senate speech, in connection with the presentation by the Senator of resolutions adopted at the recent convention of the American Mining Congress at Denver.

Senator King stated that the resolution is of such national, if not international, importance that it should be brought to the attention of Congress and referred to the appropriate committee.

The Senator also said that the chaotic condition of the world's currency has led economists to re-examine the question of bi-metallism or the question as to the function of silver in the monetary system. "The awakening of the Orient, the certain increase of trade between India, China and Japan and the nations of Europe and America, emphasize the importance of the silver question," said Senator King. "Silver has been and will continue to be employed in the Orient for monetary uses: indeed it is practically the only money in circulation in most regions of the Orient. The prosperity of the Orient and the development of trade among the peoples of Asia depend largely upon silver. If the use of silver should be restricted or its value, measured by domestic products, greatly changed, the reaction would be very great and the results could not be fully anticipated. The United States as a producer of silver is interested in the prices which it will bring. It is interested in the place which silver shall occupy in the monetary system, not only of the United States but of the world. It seems manifest that with the expiration of the Pittman Act the price of silver produced in the United States will fall much below the dollar mark, which now is the price of an ounce of silver. A great depreciation in the price of silver would be injurious to the West: indeed it is difficult to determine the effects that would flow therefrom not only to the West but to the entire country. The resolution is temperate in language, admirably phrased and contains a sound recommendation. I hope the Committee on Banking and Currency will fully investigate this important matter and make recommendation tending to secure the international stabilization of silver."

Railroads, Ships, and Public Utilities Have Priority in Distribution of Coal

Service orders extending drastic priority privileges in the transportation of coal were issued by the Interstate Commerce Commission on July 25. Under one of the orders the railroads are given authority to move coal by the most available route. Under another, the railroads are instructed to move coal, coke and fuel oil in preference to all other freight, excepting food for human consumption, feed for livestock, livestock and perishable products.

Cars for coal loading are to be furnished first for fuel intended for railroads and for the bunkering of ships; next for public utilities which directly serve the general public under a franchise. This includes street and interurban railways, electric power, light, gas, water and sewer works, and ice plants. Hospitals come next in the priority list. Other consumers then are listed in the following order: Federal, state, county and municipal governments. The order points out that the intention is that all common carriers, public utilities, quasi-public utilities and governments may be kept supplied with coal for current use, "but not for storage, exchange or sale."

Priority also is given to coal for shipment to the Northwest by way of the Lakes and to the commercial sizes of coal for domestic use. The order provides also that no coal is to be subject to reconsignment or diversion, except for some purpose in the same class or in a superior class.

The President has submitted a plan to the operators and mineworkers providing for a minimum wage for 280 days each year. The plan has as its object the elimination of those mines not in a position to furnish 280 days' work and thereby to meet the evil of overdevelopment in the industry.

Congress Is Ready to Co-operate in Solving Coal-Strike Situation

It is apparent that Congress is ready to pass, with the minimum of delay, any legislation which the President may request. It is practically certain, however, that an opportunity will be given to try out Secretary Hoover's voluntary control before any emergency legislation is requested. It has been announced authoritatively that the House will not be called back to Washington. The lower chamber has recessed until August 15.

Whether or not the administration asks it, there is certain to be an effort, before this session of Congress closes, to put through fact-finding legislation and possibly legislation giving the President special powers to be exercised in case of an emergncy.

News by Mining Districts

Johannesburg Letter

Railroad Construction Will Develop South Africa—Dividends Declared by Six Mines—New Gold Discovery Reported

BY JOHN WATSON

Johannesburg, June 20—The discovery of a gold reef near Keetmanshoop, South West Africa, has been reported during the past week. A syndicate in that district pegged eighty claims (each 200 m. square) last month. C. H. Fiebecke, of the C. I. D., is said to have the controlling interest in the syndicate. Seven shafts have been sunk and in four of these the reef had been struck at an average depth of 40 ft. Assays carried out by the Standard Bank of South Africa showed an average content of 4 oz. 11 dwt. per short ton. The reef is said to average 16 in. in width.

The Minister of Railways, J. W. Jagger, announced on June 14, a big scheme of expansion to open up districts hitherto undeveloped. Permission was granted by the Legislative Assembly to introduce a bill providing for twenty-two lines, altogether 851 miles in length at an aggregate cost of £4,087,620. These schemes should give employment to many thousands and are divided over three of the older provinces of the Union. Natal is apparently judged to have enough railways *pro tem.*

The Belmont-Douglas railway, fifty-three miles long will pass through a district of salt-pans, also through fertile and irrigated lands along the Vaal and Riet Rivers. The Fort Beaufort to Balfour 3-ft. gage railway, of twenty-three miles length, is estimated to cost £65,000 and will pass through valleys which are irrigated and well-timbered. The Franklin-Kokstad railroad, 25½ miles long, and the Franklin-Matatiele line (via Cedarville), of 47½ miles length, will open up the Transkei districts of Cape Colony. The George to Knysna line will cover a distance of forty-two miles and open up the celebrated timber forests of Knysna; the estimated cost of this section is put down at £296,820. In the Transvaal, the new railways proposed are: Dunswart to Apex, via Benoni, 40 miles long, estimated cost £115,461. Ermelo to Lotheir, 27 miles, £125,577. Hercules to Magaliesberg, 50½ miles, cost £257,196. Lydenburg to Olifantspoortje (via Ohrigstad), 71 miles, estimated cost £398,168. Nylstroom to Vaalwater, 43¾ miles, to cost £187,468. Finally Rustenburg to Boschhoek, 17 miles at an estimated cost of £64,141.

The Buffelsdoorn gold mine in the Klerksdorp district, may shortly reenter as a producer. A syndicate has recently negotiated for a lease of the mine. A find of diamonds is reported by a prospector near Machaire, in the Patchefstroon district. A shaft was being sunk at a depth of 50 to 60 ft., when a slightly colored diamond of 2½ carats and a water-white stone of ½ carat were found.

The following dividends have been declared to-day by the Rand Mines Group:

	Dividend No.	Rate of Dividend Per Cent	Per Share	Par Value
City Deep	20	7½	1s.6d.	£1
Crown Mines	42	5	6d.	10s.
Nourse Mines	34	2½	6d.	£1
Rose Deep	42	5	1s.-6d.	£1
Modder B	20	30	1s.-6d.	5s.
New Modder	32	20	2s.-0	10s.

London Letter

Union Miniere Has Nearly 4,500,000 Tons of Copper in Congo Property —Largest Producer in 1921

BY W. A. DOMAN

London, July 14—The annual report of the Union Miniere du Haut-Katanga for 1921 makes a remarkable showing in the matter of estimated ore reserves. Prospecting operations were continued in the southeastern and western part of the concessions. Only in the southeastern part were the figures contained in the report taken as really reliable, those relating to the western part being preliminary only. Baldly stated, the position is:

	Ore, tons	Copper, tons
S. E. end 1921	46,348,000	2,812,8100
S. E. end 1920	32,300,000	1,869,00
Increase	14,048,000	943,310

At the end of 1920 the average copper content was 5.78 per cent, and in December last it was 6 per cent, the new tonnage brought in during the year assaying 6.7 per cent. Preliminary estimates in the western portion are:

	Ore, tons	Copper, tons
Copper 15 per cent and over	1,736,000	286,000
Copper under 15 per cent	9,800,000	587,247

The tonnage of ore above 15 per cent averages 16.4 per cent, and under 15 percent the average is 6 per cent. If the preliminary estimates in the western section should prove on further work to be warranted, the total ore-reserve position, as shown in the directors' report, would stand thus:

Group	Ore, tons	Copper, per cent
S. E.	903,000	17.2
West.	1,736,000	16.40
S. E.	14,807,000	8.00
West.	9,800,000	6.00
S. E.	23,358,000	5.97
S. E.	7,280,000	2.72
Total	57,884,000	6.36

Ore containing above 15 per cent is apparently classed as ore for smelting, 8-per cent ore is for concentration, and 6-per cent ore presumably will be treated by the leaching process. The experimental electrolytic leaching plant started running in November last, and the results obtained entirely confirm the estimates. The lower grade ores are the sulphide ores. The above analysis will indicate how great a part leaching is expected to play in the company's fortunes in the future.

Since writing the above, a cablegram has been received from the property giving the following supplemental figures:

Southeastern group	Ore, tons	Copper, per cent
Leaching ore	2,000,000	17
Concentrating ore, 11,000,000 @ 7.4 per cent, giving a tonnage of concentrates for smelting about	2,000,000	22
Total: Ores and concentrates for smelting	4,000,000	19.5
Ores for leaching	25,000,000	5.9
Sulphide ores	7,300,000	2.7
Mixed ores (sulphide and oxide)	5,000,000	5.7
Western group		
Ore for smelting	1,600,000	16.7
Ore for leaching	13,000,000	7.2

Classifying the ore reserves according to their character, we obtain the following figures:

	Ore, tons	Copper, tons
Smelting ore	3,600,000	607,000
Ore for concentration	11,000,000	815,000
Ore for leaching	38,000,000	2,411,000
Total oxide ores	52,600,000	3,833,000
Sundry ores:		
Sulphide ores	7,300,000	197,000
Mixed ores	5,000,000	285,000
Total sundry ores	12,300,000	482,000
Grand total	64,900,000	4,315,000

Last year, 195,800 tons of ore was sent to the smelter, and 201,925 tons to the concentrator. The smelter treated a grand total of 390,953 tons, of which 56.9 per cent represented ores, and 43.1 per cent fluxes. The production from the above was 30,464 tons of copper, 30,185 tons being in the form of bars, and 279 tons of matte.

Although the company has continued working—and on an increasing scale while other producers have been compelled to cease—the question of closing down was seriously considered early this year, owing to the fall in the price of the metal and to the rise in costs. A solution of the difficulties seems to have been arrived at by a reduction in the rates of transport. Transport is an important item—50 per cent of the production costs—not only for the Union Miniere, but for the transport companies themselves, and rates have been reduced as from Jan. 1 last. They are based on the selling price of the metal, and consequently benefit all parties. Last year, the Union Miniere was the largest copper-producing concern in the world.

CANADA

Ontario

Kirkland Gold Company Is Cutting Station at 1,025 ft.; Deepest Working in District—Hollinger Produces $1,000,000 Per Month

Cobalt—During June four companies shipped a total of 230 tons of ore from Cobalt: Coniagas 43.6 tons, La Rose 33 tons, Mining Corporation 89.3 tons, and O'Brien 64 tons. Of this total 64 tons went to Ontario smelters and the balance to the United States.

During the week ended July 14, the Mining Corporation shipped 87 tons, and La Rose 33 tons of ore from Cobalt.

Kirkland Lake—Arrangements are being completed for the early resumption of work on the Baldwin property.

The shaft at the Bidgood is being sunk from the 500 to the 600 level.

Two diamond drills are at work on the Elstone-Dunkin property, which is under option to the Thompson-Chadburne interests.

The Kirkland Gold is cutting a station at the 1,025 level in the main shaft, which is the deepest working in the Kirkland district.

Teck Hughes mill heads are running exceptionally high, and it is believed that the July output will constitute a record.

The capital of the Boston Creek mine has been increased from 2,000,000 to 4,000,000 shares of $1 par. The increase is for the purpose of completing the amalgamation with the R. A. P. syndicate and the Kelsey, and the financing of the merged properties.

West Shining Tree—The Tonopah Mining Co., of Nevada, has taken an option on the Herrick property. Under the agreement the shaft is to be sunk to 400 ft. and 2,000 ft. of lateral work will be done. The deal calls for the Tonopah company to put the property on a producing basis if the results prove to be sufficiently satisfactory.

Porcupine—The shaft being sunk by the Kerr Lake on the Goldale property is now down 400 ft., and an average of 140 ft. a month is being attained. At 500 ft., lateral development will be started.

The Hollinger tonnage continues to average 4,000 per day, which represents a production of about $1,000,000 a month.

Arrangements are being made to diamond drill the Gold Centre property.

It is understood that the campaign of deep diamond drilling undertaken by the Davidson is showing good results and that values from $7 to $10 are being obtained over widths of from 10 to 20 ft. One hole will be drilled to cut the orebodies at a depth of 2,000 ft.

Directors of the Clifton have advised the shareholders that sufficient money has been received from the sale of treasury stock to finance the building of a small mill.

British Columbia

General Activity Prevails at Cambourne —Cunningham Mill at Alamo Will Be Re-started

Kaslo—Sinking of the winze and other development at the Cork-Province mine has been delayed by drafting of a part of the mine crew into the Forestry Department's fire-fighting crews.

Trout Lake—With the lowering of the water in the upper Lardeau River, placer mining operations by a Victoria syndicate are expected to be under way in full swing.

The Silver Crown Mining Co. in which Spokane capital is interested, has commenced preliminary operations at the Foggy Day group, which was bonded recently from Mrs. A. E. Jowett. The property is situated near the Silver Cup mine, and carries free-milling gold. It is planned to commence construction of a small mill soon.

Ferguson—The old Silver Cup mine buildings and warehouses at Five-Mile were destroyed early in July by forest fires. Damage to other mining property in the vicinity was threatened for a time.

Cambourne—It is understood that a syndicate is negotiating for a number of mining properties in this vicinity; prospects are that deals aggregating $200,000 in final payments will be made. Development is being done on a number of the free milling properties of the camp, and in general activity has been greater than for a number of years.

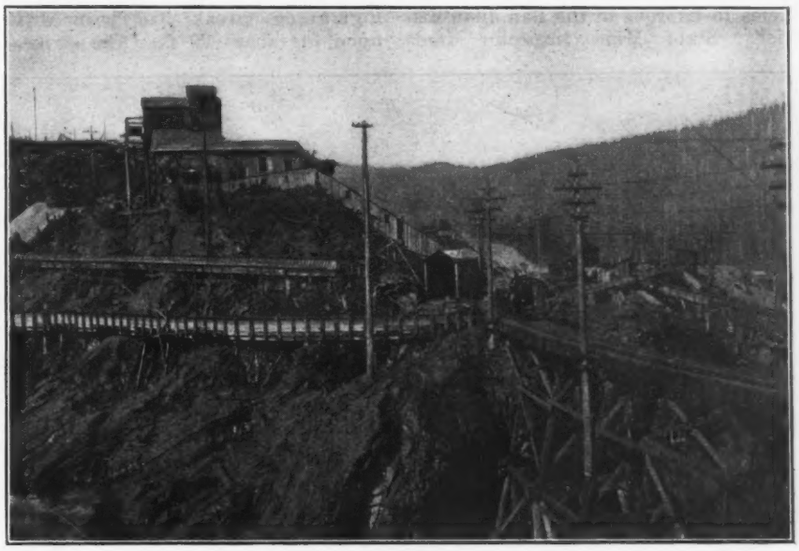
Salmo—The mill of the Nugget Mines, Ltd., resumed about the middle of July.

Development on the Reno property, 4½ miles from the Nugget, by W. B. Pool and son, has opened free-milling gold quartz at a depth of 100 ft. Much of the gold is so coarse as to be easily visible to the naked eye.

Nelson—A strong showing of copper-gold ore is being opened up on the Spokane Mining & Development Corporation's property at Beasley. An orebody was cut which has a width of 35 or 40 ft., and which samples 4 per cent copper and 60c. per ton in gold.

Three Forks—Repairs have been completed to the compressor plant of the Rambler-Cariboo mines, damaged in the spring by a snowslide.

Alamo—Preparations have been in progress recently for resumption of operations at the Cunningham mill, which was built three years ago for handling the ores of the Wonderful, Queen Bess, Slocan Sovereign, and Idaho-Alamo mines.



Experimental flotation plant of Granby Consolidated Mining, Smelting & Power Co. at Anyox, B. C.

WASHINGTON

Inventory of Equipment at Northport Smelter Is Underway

Spokane—A move is on foot to affiliate the various mining organizations here with the American Mining Congress, and co-operation is being sought of mining interests of the western side of the state to the end that Washington may receive proper representation.

Keller — Arrangements are being made by the Addison Copper Co. with county officials for assistance in constructing a road to the mining property of the company. As soon as the work is completed, a start will be made on ore production.

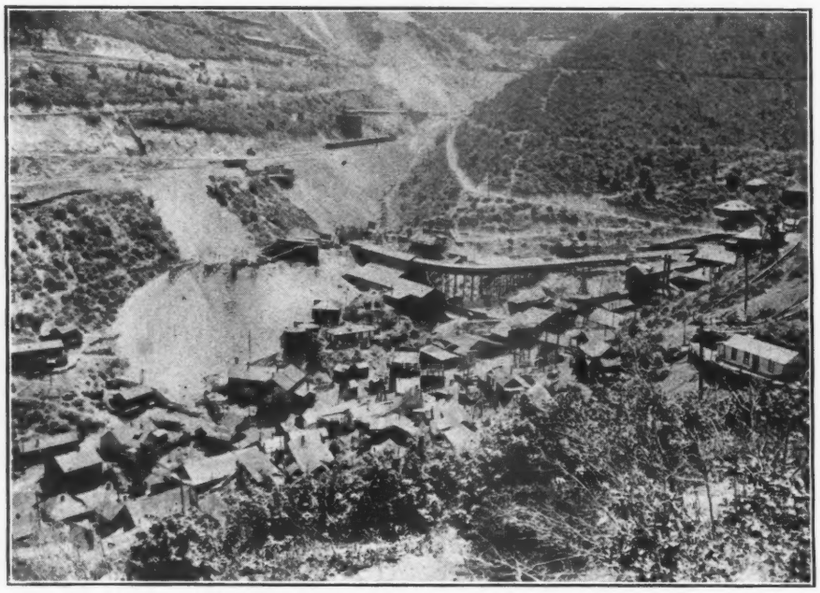
Northport—An inventory of the equipment of Northport Smelting & Refining Co. has been taken lately by parties said to be representatives of the American Smelting & Refining Co. Much conjecture is afloat as to what the plans of the Northport company are. The company is controlled by the Days, but freight differentials on ore from their mines to this point and from here to the refinery at Pittsburgh,

Pa., have operated so as to make the smelting enterprise an unprofitable one. In view of the recent election of Harry L. Day, traffic director and business head of the Day family affairs, to the directorate of the American Smelting & Refining Co., it is believed that the A. S. & R. Co. has, or will take over the smelter.

COLORADO

New Bonanza Orebody in Portland Mine Proves Large—Fire Causes $75,000 Loss at Tomboy

Silverton—The mining situation continues to improve in the San Juan district. State Mine Inspector Innis states that "there is more actual development of ore under way, more production being made and a greater ultimate production indicated than for many months past." The Iowa-Tiger mill under operation by the Melville Mining & Milling Co. was started July 5. The mill is being operated on two shifts and is producing at a rate of about twenty cars of concentrate per month. The third shift will be put on as soon as ore now being developed is ready for breaking.



Mine plant of the Utah Consolidated Mining Co., Carr Fork, Bingham, Utah

Telluride—The Tomboy Gold Mines Co. suffered a loss of at least $75,000 by the burning of the boarding house, machine-shop, club-house, blacksmith-shop and other small buildings, on July 15. The fire originated in the basement of the boarding house from an unknown cause. It was necessary to blast out snow sheds and other buildings to prevent the spread of the flames to the mine workings and other buildings. Operations at mill and mine were suspended but a short time and rebuilding was commenced as soon as the wreckage could be cleared.

Cripple Creek—The recent strike on the 2,600 level of the Portland mine at Cripple Creek gives promise of developing into one of the notable discoveries of the gold camp and already is compared with the "jewelry shop" of the Independence or the "Cresson vug." The vein is 10 ft. wide and 3 ft. of it is of the highest grade. In the core it is said to be almost pure sylvanite. Estimates of the richer part of the vein are over $10,000 per ton. Sack shipments to the sampler were settled for at over 500 oz. The discovery is at the deepest point at which ore has ever been mined in the Cripple Creek district. The new orebody has been opened for a distance of 60 ft. and the high-grade streak has been drifted upon for about 20 ft. The strike on the Portland as well as several other surface finds, notably on Beacon Hill, has brought out a new crop of prospectors and much of the spirit of old boom days is in evidence.

UTAH

Bingham Galena Again in Bad Grace with Securities Commission

Salt Lake City—Questionnaires regarding mining operations have been prepared by the mines committee of the Salt Lake Commercial Club for distribution upon request to Utah mine operators. This is being done with a view to bringing mining operators and investors into closer touch. The data obtained from the questionnaires will be tabulated by the committee and prepared for distribution free of charge. Answers will be accepted by the committee with the understanding that the Commercial Club assumes no responsibility, either directly or indirectly, to owner or investor for the statements as made nor for the result of their distribution. Nothing will be added to the statements as received.

The permit of the Bingham Galena to sell stock has been withdrawn by the Utah Securities Commission. This is the second permit given the company; it is withdrawn owing to the company's failure to keep up payments on the lease and option held on the Lost Packer property in Idaho, which it undertook to acquire upon receipt of the permit. The first permit was withdrawn as a consequence of sundry transactions with George Graham Rice, which elicited strenuous protest by reputable mining interests.

Eureka—Shipments for the week ended July 15 amount to 101 cars. Shippers were: Tintic Standard, 24 cars; Chief Consolidated, 20; Iron Blossom, 14; Victoria, 7; Grand Central, 7; Colorado, 5; Tintic Drain Tunnel, 4; Centennial-Eureka, 3; Eagle & Blue Bell, 3; Swansea, 3; Gemini, 2; Mammoth, 1; Alaska, 1.

Park City—Shipments for the week ended July 15 amount to 2,821 tons. Shippers were: Ontario,, 850 tons; Silver King Coalition, 774; Park-Utah, 765; Judge, Daly, and Daly West, 432 tons.

Shipments both here and at Eureka are below normal, following the Fourth of July shut down.

Alta—The South Hecla is beginning shipments. Difficulties from water and gas have abated. The Columbus-Rexall from June 12 to July 12 shipped 20 cars of ore, amounting to about 1,000 tons. The winter accumulation of ore has been marketed, but it is expected to mine and ship about 20 tons of ore daily throughout the shipping season.

Big Cottonwood—At the Woodlawn property, the survey has been brought up to date and a geological examination has been made. A winze is being sunk from the 700 level, where drifting has also been started to cut a vein opened on the main tunnel level 200 ft. higher up. The Alta Tunnel & Transportation Co. is shipping about 6 tons of ore daily, in spite of water flowing down the raises. The water, however, is growing less, and conditions are expected soon to be normal in this regard.

NEVADA

Nevada Packard Mill Exceeds Former Record—Betty O'Neal Flotation Plant Nearing Completion

Special Correspondence

Virginia City—It is persistently rumored that the Middle Mines group is to be again taken under option by eastern interests. The mines and district have recently been examined by mining engineers said to represent prominent New York and Boston financiers.

Rochester—June production of the Rochester Silver Corporation was 4,969 tons, gross value $46,650, and net profits $9,532.93, which is about normal for the company. Mine conditions are said to be good; the Windlass vein has been cut in two raises from the 500 level at points about 65 ft. below the 250 level. Both raises show commercial ore. The northwest drift

on the 500 level is following the Windlass vein in low-grade ore.

The cyanide mill of the Nevada Packard Mines Co., in the Rochester district, is treating 160 tons of ore daily. This is the largest tonnage ever treated by the company. The Packard mine is worked through tunnels to a maximum depth of 250 ft. The orebodies as a whole are large and of low-grade, but operating costs are low.

Battle Mountain—The 100-ton flotation plant of the Betty O'Neal Mining Co. will be completed in September. The main drainage tunnel has entered heavy ground only a short distance from a connection to the old workings and it has been necessary to spile for the past 35 ft. The tunnel is already slowly draining the old mine workings. The north drift on an intermediate level, 80 ft. below No. 3 tunnel, has been in $90 ore for the last 20 ft.

Tonopah—Production in the district is about as usual. There is still a scarcity of skilled miners although operations have not been hampered as yet. So far no effect of the coal or railroad strikes has been felt.

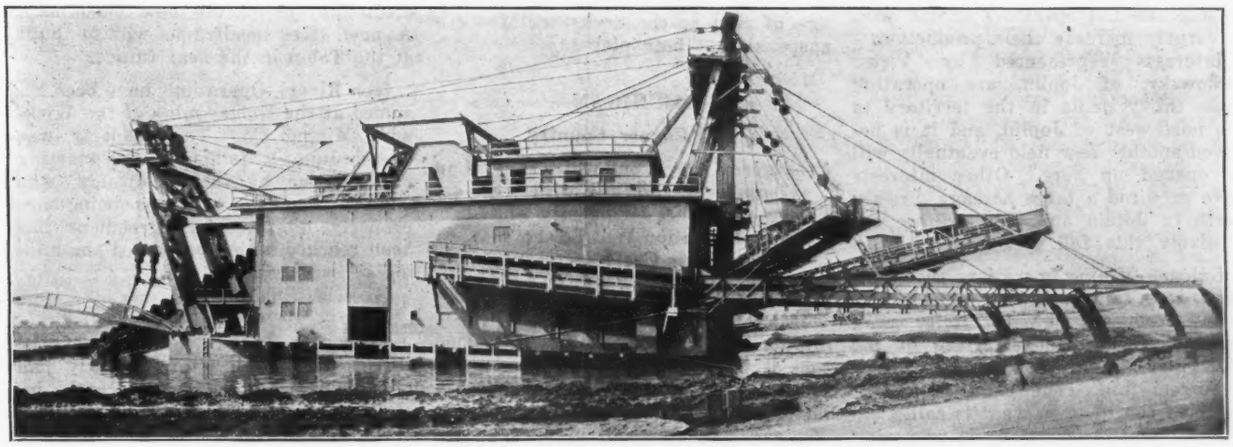
Golden Arrow—The option on the Storm Cloud group of claims, located five miles south of Golden Arrow, which was held by George Wingfield and associates, has been released. Development failed to disclose any great extent to the bunch of high-grade ore discovered on the surface.

Goldfield—June production of the Silver Pick lease in Red Top ground was 325 tons, average value about $50 per ton. This is a decrease of 275 tons from May production.

Pioche—Active development of the holdings of the Amalgamated Pioche Mines & Smelters Corporation is announced by William J. Palmer, president of the company, and Hugh R. Van Wagenen, general manager. The territory between the Greenwood orebody, opened by the Combined Metals Co., and the Susan Duster mine, worked some years ago by the Ohio Kentucky Mining Co., has been recommended as promising. A drift will be run from the Amalgamated No. 1 shaft at the 400 level extending east to the Susan Duster incline shaft sunk by the Ohio Kentucky Co. The work will be done under the management of S. F. Whitney, resident manager.

Shipments continue to go forward from the Prince Consolidated tailings at Bullionville, in spite of the strike. During the past week, several trains have been run to Pioche and the situation appears to be easing, with fourteen engines in bad order in the yards at Caliente a week ago and only three now.

Ore has been struck at a depth of 100 ft. in the new vertical shaft of the Pioche Bristol mine at Jackrabbit. The vein is in the lime spar and has a good lead-silver content. W. E. Brodie, of Pioche, is in charge of the development.



An operating gold dredge in California

CALIFORNIA

Mine Assessments Reduced—Deposit of Diatomaceous Earth Will Be Opened—Gold Production Increases

Special Correspondence

San Francisco—The county supervisors have cut the tax assessment of the Iron Mountain Copper Co., Riverside County, and the Mammoth mine of the U. S. Smelting, Refining & Mining Co., in Shasta County. Both mines have been inoperative since early in the war. The reduction was one-third of the original assessment.

A suit involving 80,000 shares of stock in California Rand Silver, Inc., instituted last September by E. L. Blanck against J. J. Noser, owner of the stock, has been settled out of court. Noser and Blanck will each receive 40,000 shares.

Assessment work has been done on twenty-seven mining claims in the northeastern part of Shasta County on deposits of diatomaceous earth. The work and improvements consisted of digging pits, building roads, and erecting buildings for the purpose of developing the mining claims in pursuance of a general plan for the ultimate extraction, shipping, marketing and manufacturing of the diatomaceous earth. The claims lie in Township 37 N., Range 3 E., and in close proximity to the Pacific Gas & Electric Co.'s railroad from Bartle to Pit No. 1. Several miles of this road are ballasted with diatomaceous earth.

California, in 1921, produced gold to the value of $15,704,822, according to figures announced by the U. S. Geological Survey. The production in 1920 was $14,311,043. The silver yield was worth $1,859,896 in 1920 and $3,629,233 in 1921. Copper production fell from 12,626,272 lb. in 1920 to 11,743,404 during 1921.

The Central Eureka company's crusher house and ore bins near Sutter Creek, Amador County, are in course of construction. It is expected that the shaft will be ready for mining operations within a month.

A strike of ruby silver ore is reported on the 400 level of the Bray & Bisbee mine in the Randsburg district.

The Shasta Zinc & Copper Co. is treating 150 tons of ore daily at its plant near Winthrop. Zinc oxide is the principal product, but copper, silver and some gold are also recovered.

JOPLIN-MIAMI DISTRICT

Shortage of Miners Is Still Felt—Drilling Northwest of Joplin May Disclose New Field

BY P. R. COLDREN

Joplin—Heavy rains on July 16 and 17 put several mines in the Picher section of the Tri-State field temporarily out of commission. Among them was the Underwriters' Land Co.'s No. 4 mine at Douthat, and the Acme. The Underwriters' had been pumping from 1,500 to 2,000 gal. per hour regularly from their lower level. The heavy rains did not affect the lower level at all, but the upper level was virtually flooded.

Despite a steadily improved price for zinc ore, the increase in the number of operating properties is not as great as had been anticipated, and at this writing the total number of producers is reported at 103. Several more

will soon be in the producing column, including the Texas, which is to be run by the Vinegar Hill Zinc Co., and a new mine for which a mill is now being erected on a lease in Kansas, north of Picher, by John Robinson, of Miami.

Several mines that have started up in the past two months have been forced to close down again through their inability to get enough shovelers to secure a tonnage of dirt sufficient to make their operations profitable. This shortage of good workers is somewhat relieved now, since men have come back from the harvest fields, but it would quickly become apparent once more if ore prices should continue to improve and operators should wish to largely increase their production.

Interests represented by Victor Rakowsky, of Joplin, are operating some thirty drills in the territory to the northwest of Joplin, and it is believed another new field eventually will be opened up here. Other interests have acquired a large acreage directly north of Joplin and plan drilling extensively this fall.

Galena—Mining operations that have been at a standstill for almost two years promise renewed activity as a consequence of the restarting of the McKinney Mining Co.'s concentrator, as a custom mill. The plant is located north of the town in what is called old Empire, and the company is preparing to work the ground on the lease, as well as handle ore mined on other near-by tracts. This will help the small operator particularly. The Eagle-Picher Lead Co. owns the first lease on this property for ore below the 200 level, and is starting drill-prospecting on the tract. Three holes will be put down, to be followed by others if ore is found.

MINNESOTA

Coal Shortage on Minnesota Iron Ranges Cause of Uncertainty Among Operators

Hibbing—There is a marked feeling of uncertainty among the iron-ore operators on the Mesabi and Vermilion ranges due to the unsettled transportation facilities, both on the railroads and boats. At present, some of the operators have been compelled to close a few of the mines and mills, while others have curtailed their production due to the inability of the railroads to supply cars. This inability is caused by the lack of help both in the repair of the locomotives and the cars.

A second factor which is tending to retard iron-ore operations is the supply of coal for the lake freighters. At many ports only a limited amount of coal is allowed a boat, while at every port considerable shifting must be done to obtain sufficient coal for a trip one way. The price of coal is becoming too expensive for most operators. Should this condition continue, it will be necessary to tie up many of the boats which will also cause curtailment of mining on the ranges. It is imperative that a change for the better must occur in the near future or a serious curtailment will take place. The coal supply of the iron-ore operators is sufficient for a continuation of their activities for some time, as large quantities are generally placed in storage for months of operation.

Duluth—The coal situation relative to the furnaces and mills of the Minnesota Steel and the Zenith Furnace companies here, although not yet acute, threatens to curtail operations. Operations at both plants will continue as there is sufficient coal on hand for the immediate present but a continuation of the coal strike and subsequent shortage of coal at the docks will force a suspension at both plants.

MICHIGAN

The Copper Country

Producers Are Confident They Can Compete Successfully with Western Mines—Efficiency of Operation Will Lower Costs

BY M. W. YOUNGS

Houghton—In the Calumet & Hecla tailing deposit there is 40,000,000 tons of material containing an average of 14½ lb. of copper per ton. Approximately 2½ lb. is lost in retreatment. The sands farthest out in the lake are dredged during the summer, those inshore being taken out in winter on account of ice in the lake. The sands farthest out are the newer tailings and are not as rich as those inshore. So while the reclamation plant may be working to capacity in summer the recovery may not be as high as it is during the winter.

Resumption of work on the Tamarack reclamation plant and haulage way in the Calumet & Hecla conglomerate department, extensive repairs to the Red Jacket shaft of Calumet & Hecla, construction of a new steel rock-house at No. 2 shaft, Trimountain, and the running of a survey for the proposed railroad from the Ahmeek mine to the mill are all cited as evidences of faith in the Lake district and forerunners of a return of normal activities and prosperity. There is no fear, here at least, that the Lake mines will fail to compete successfully with the producers of the west and southwest.

Calumet & Hecla has not yet resumed the work of exploring the Kearsarge lode encountered by a crosscut from the 81st level of the Red Jacket shaft and will not do so until repairs under way in the shaft are completed. When this work is taken up again, drifts will be continued in both directions on the vein in the hope of uncovering better values than have been found to date.

At No. 2 Gratiot shaft, Seneca, a station has been cut at the 13th level preparatory to drifting north, and a station will be cut now at the 11th level, at which point a drift will be driven to the south. The lode was opened in this shaft by means of a raise from the 13th to the 11th level and it is for the purpose of more thoroughly opening and testing this ground that the drifts will be run.

Menominee Range

Crystal Falls—A new electric hoist is being installed at the Tobin mine of the McKinney Steel Co. It was manufactured by the Nordberg Manufacturing Co., of Milwaukee. It will be driven by a 500-hp. motor and will be able to handle a skip from a depth of 2,600 ft. The drums are 9 ft. with a 10-ft. face and are geared to a rope speed on the skip of 1,500 ft. per minute. A new brick building is being erected to house the new machinery. A new steel headframe will be built at the Tobin in the near future.

Iron River—Operations have been resumed at the Homer mine of the Wickwire Mining Co. The property was closed June 1, following the starting of litigation by the fee-owners, who claimed that the ore was being improperly mined. An agreement has been reached which permitted the mining of ore again.

Gogebic Range

Ironwood—The Davis mine, of the Oliver Iron Mining Co., recently had an unexpected test of its recently installed pumping plant. The 2,600 level crosscut struck a vug of some size and the sudden rush of water necessitated closing the dams on both that and the 2,400 level, while the reserve pumps were started and run at capacity. There are three 400-gal. electric-driven pumps with forged-steel water ends pumping to the surface in one lift, this being 2,600 ft. The pumps and dams all worked satisfactorily, so no great damage was done. The dams are built of concrete with steel frames for the doors and heavily reinforced with steel rods. The doorways are 6 ft. by 6 ft. in the clear so that motor haulage is uninterrupted when the doors are open. They were designed to withstand a pressure of 200 lb. per sq.in.

It is beginning to appear that the mines in this district will be faced by a labor shortage by fall. At present when no especial effort has been made to get new employees, there are few men looking for work, and several mines have been unable to get back their old employees who were laid off last fall. A short time ago several agents were here looking for men to go to the western copper camps but did not get many recruits. Most of those leaving the district are young men who are going to Detroit, Flint, Lansing, and Muskegon to work in the automobile factories, where pay is higher.

The strike of the railway car and shopmen is beginning to affect car service at the mines. There is some shortage of locomotives in serviceable condition, and several mines have been without cars for short periods. As in other districts, train service is being curtailed where it does not interfere with handling the mails.

THE MARKET REPORT

Daily Prices of Metals

July	Copper, N. Y., net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
20	13.625	31.125	31.75	5.65@5.75	5.375@5.40	5.775@5.825
21	13.625	31.375	32.00	5.65@5.75	5.375@5.40	5.825
22	13.625	31.375	32.125	5.65@5.75	5.375@5.40	5.85
24	13.625	31.375	32 25	5.65@5.75	5.35 @5 40	5.875
25	13 625@13 75	31.50	32.25	5.65@5.75	5.375@5.40	5.90
26	13.625@13.75	31.625	32.50	5.75	5.375@5.40	5.925

*These prices correspond to the following quotations for copper delivered: July 20th to 24th inclusive, 13.875c.; 25th and 26th, 13.875@14c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

July	Copper Standard Spot	Copper Standard 3M	Copper Electrolytic	Tin Spot	Tin 3M	Lead Spot	Lead 3M	Zinc Spot	Zinc 3M
20	63 1/8	63 3/8	70 1/2	156 1/2	156 7/8	25 1/2	24 1/8	29 5/8	29 1/2
21	63 1/4	63 5/8	70 1/2	157 1/4	157 5/8	25 5/8	24 1/8	29 5/8	29 1/4
24	63 1/2	63 3/4	70 1/2	158	158 1/4	25 5/8	24 1/8	29 5/8	29 1/4
25	63 3/8	63 5/8	70 1/2	158 1/4	158 3/8	25 5/8	24 1/8	29 5/8	29 1/4
26	63 3/8	63 5/8	70 1/2	160 1/4	160 1/4	25 1/4	24 1/2	29 5/8	29 1/2

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

July	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London	July	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London
20	444 7/8	99 3/8	70	35 1/2	24	445 3/4	99 1/4	69 3/4	35 1/8
21	445 3/8	99 3/8	69 5/8	35 1/4	25	445 1/2	99 3/8	69 1/2	35
22	445 1/4	99 3/8	69 3/8	35 1/8	26	444 1/2	99 1/8	69 3/4	35 1/8

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths of a cent premium.

Metal Markets

New York, July 26, 1922.

Although sales of the major nonferrous metals were generally lighter than last week a better tone is discernible in the market. Producers as a whole have been unwilling to cut prices in order to obtain business in a dull market, and the strike situation, although serious, has not disturbed the metal industries to a great extent. Zinc has been the feature metal of the week and has recorded another rapid advance, bringing that metal to the highest price of the year.

Copper

Copper has been available all week at 13.875c. delivered. Last Thursday and Friday a plentiful supply was to be had and the metal was freely offered on that basis from several different directions. During the last two days, however, it has become more difficult to procure copper at that price, as one or two producers who were selling for 13.875c. earlier in the week are now holding for 14c. They have been able to do this because they have found themselves well sold out of copper for prompt shipment. This has strengthened the position of the largest producers who have consistently held their metal at 14c. but without making many sales. The copper market seems to be marking time in anticipation of another buying wave, with sellers indisposed to sell and buyers not anxious to buy. The metal has been offered for future delivery as far ahead as October, November and December for the same price as early shipment.

Export business has been mediocre as for some time past. The copper market is depending for support on a greatly improved domestic consumption rather than foreign purchases which is the reverse of the situation prevailing a few months ago. Export business has netted producers about 13.90c. f.o.b. refinery.

Lead

The official contract price of the American Smelting & Refining Co. continues at 5.75c. per lb. New York.

Sales of lead have been good. A large majority of the sales were made in the New York market, and several of them were for heavy tonnages—900 to 1,000 tons each. Demand was greatest from paint and storage battery manufacturers. In one large transaction, settlement was made on an average price basis but the bulk of the eastern business was transacted on a 5.65c. price although some good-sized commitments were made at 5.75c. In St. Louis the market has been quiet. Lead was obtainable throughout the week for 5.40c. in hundred-ton lots, and some metal was sold on Monday at 5.35c. Since then, however, there has been a slight stiffening of the market and it is doubtful whether any large amount of metal can now be obtained on that basis. A firmer tone also exists in the New York market. The Spanish lead, an excellent corroding grade, which has been hanging over the market for many months, was sold during the week to two parties and is no longer the factor it was. It is noticeable that the freight differential of 35 points is again being fully expressed in the relation of the New York and St. Louis markets.

Zinc

The zinc market showed an unbroken advance during the week and is now close to a 6c. level. The price at which zinc has been sold today, 5.925c., is higher than any market price since December, 1920, at which time zinc was on a decline to unusually low levels. All producers report good sales. The excellent statistical position of zinc has placed the market in the hands of the producers. Production will doubtless be stimulated by the rise in price of zinc but will be handicapped by a labor

shortage and trouble with fuel supplies. The high cost of concentrates does not permit much profit to the smelter even at present prices. Zinc is now definitely higher than lead. The New York price is 35 points above the St. Louis market.

High-grade business continues to be satisfactory and a further rise in price is recorded to 6¾c. with 30c. per 100 lb. freight allowance. Brass mills have been important purchasers.

Tin

The market has been quiet and has been featured by a shortage of spot 99-per cent grades for which a premium is being asked amounting to almost one-quarter cent over September shipment. Straits may be obtained for forward delivery at the same level as prompt. The tinplate trade is still out of the market. The price of tin in London has risen sharply during the past week and advanced £2 today, which has caused a rise in the New York market.

Arrivals of tin in long tons: July 20th, London, 100; 21st, Straits, 25; 24th, Australia, 25; 25th, Straits, 650; China, 50.

Gold

Gold in London: July 20th, 92s. 7d.; 21st, 92s. 6d.; 24th, 92s. 5d.; 25th, 92s. 5d.; 26th, 92s. 7d.

Foreign Exchange

The foreign exchange market displayed weakness and irregularity during the week. Francs and lire were especially susceptible to the tendency. On Tuesday, July 25th, francs were, 8.39c.; lire, 4.61c.; marks, 0.197c.; Canadian exchange, ⅜ per cent discount.

Silver

For the first part of the week, the market continued quiet with a downward tendency, San Francisco showing very little interest for silver for China shipment, except at relatively low levels.

On July 25 and 26, however, the New York market improved on the strength of local demand, and buying by the Indian bazaars also advanced the price in London on the latter date. The tone is steady at the close.

Mexican Dollars—July 20th, 53½; 21st, 53½; 22d, 53; 24th, 53¼; 25th, 53⅛; 26th, 53¼.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—20.10c. per lb. for 99 per cent grade; 19.10c. for 98@99 per cent; 18c. for 94@98 per cent. Outside market nominal at 17.75@18.25c. for 98@99 per cent virgin grades.

Antimony — Chinese and Japanese brands, quiet but firm at 5.25c. W.C.C., 6@6.25c. Cookson's "C" grade, 7@7.50c.

Bismuth—$2@$2.10 per lb.

Cadmium—$1.20@$1.25 per lb.

Iridium—$170@$175 per oz.

Nickel—Standard market, ingot and shot, 36c.; electrolytic, 39c. Outside market, 31@33c. per lb.

Palladium—$55@$60 per oz.

Platinum—$90 per oz. Strong.

Quicksilver—$55 per 75-lb. flask. San Francisco wires $54. Firm.

Selenium—$1.75@$1.85 per lb.

The prices of **Cobalt, Magnesium, Molybdenum, Monel Metal, Osmium, Rhodium, Thallium** and **Tungsten** are unchanged from prices given July 8.

Metallic Ores

Manganese Ore—29c. per long ton unit, seaport.

Iron Ore, Chrome, Magnetite, Molybdenum, Tantalum, Titanium, Tungsten, Uranium, Vanadium, and Zircon ore are unchanged from the quotations published July 8.

Zinc and Lead Ore Markets

Joplin, Mo., July 22—Zinc blende, per ton, high, $37.55; basis 60 per cent zinc, premium, $36; Prime Western $35; fines and slimes, $33@$31; average settling price, all grades of blende, $33.46. Calamine, basis 40 per cent zinc, $17.

Lead, high, $84.05; basis 80 per cent lead, $77.50 @ $80; average settling price, all grades of lead, $80.48 per ton.

Shipments during the week: Blende 10,268 tons, calamine 64 tons, lead 1,772 tons. Value, all ores the week, $485,350.

Diverting a large number of cars for grain movement has lowered the number that can be secured for shipments of ore, and those received are of a poorer assortment and of less capacity. Lack of cars and fears of having ore tied up in transit caused a slight lowering of demand this week. With 8,500 tons sold against 13,000 tons last week, which was an unusually heavy purchase, the average this month is 10,320 tons per week. Hopes of an early settlement of the railroad strike no longer being anticipated, the market situation weakened at the close tonight.

Platteville, Wis., July 22—Blende, basis 60 per cent zinc, $36 per ton. Lead ore, basis 80 per cent lead, $78 per ton. Shipments for the week: Blende, 319 tons; lead ore, none. Shipments for the year: Blende, 8,882 tons; lead ore, 1,094 tons. Shipped during the week to separating plants, 1,348 tons blende.

Non-Metallic Minerals

Barytes—Washed crude, 92 per cent $BaSO_4$ guaranteed, $8 to $9 per long ton f.o.b. Georgia points; off color ground No. 1 grade $20, No. 2 grade, $15.

Feldspar—No. 1 pottery grade active at $6.50 per ton, North Carolina. Pottery grade in Maine, $18; No. 2 ground to 90 to 100 mesh, $10; No. 1 ground to 140 mesh, $16, f.o.b. mills, N. C.

Talc—200 to 300 mesh, including containers, $13.50@$14.75 f.o.b. New York state mills. In California, 200 mesh, $16@$18 per short ton; 300 mesh, $25@$30, bags extra at cost.

Asbestos, Bauxite, Borax, Chalk, China Clay, Emery, Fluorspar, Fuller's Earth, Graphite, Gypsum, Limestone, Magnesite, Mica, Monazite, Phosphate, Pumice, Pyrites, Silica, and Sulphur are unchanged from the prices published July 8.

Mineral Products

Arsenious Oxide (white arsenic)—7.50c. per lb.

Potassium Sulphate and **Sodium Sulphate** are unchanged from quotations of July 8.

Copper Sulphate—Large crystals, 6.50c. per lb.

Sodium Nitrate—$2.25@$2.65 per 100 lb., ex vessel Atlantic ports.

Ferro-Alloys

Ferrocerium, Ferrochrome, Ferromanganese, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium, and Ferrovanadium are unchanged from the prices published July 8.

Metal Products

Copper Sheets—New York base, 21c. per lb.; wire, 15.50@15.75c. net.

Nickel Silver—27.5c. per lb., for 18 per cent nickel Grade "A" sheets.

Yellow Metal—Dimension sheets, 18.25c.; rods, 15.25c. per lb.

Lead Sheets and **Zinc Sheets** are unchanged from the quotations published in the July 8 issue.

Refractories

Magnesite Brick—$56 per net ton.

Magnesite Cement — $35@$40 per ton.

Silica Brick—$33@$41 per 1,000, f.o.b. shipping points.

Bauxite Brick, Chrome Brick, Chrome Cement, Firebrick, and **Zirkite** are unchanged from the prices appearing in the issue of July 8.

The Iron Trade

Pittsburgh, July 25, 1922.

Production of both pig iron and steel is decreasing rather rapidly on account of restriction in fuel supply traceable chiefly to the railroad strike.

Steel buyers appear to have become somewhat timid as to purchases for delivery late in the year, partly on account of uncertainty as to business conditions and partly because steel already bought will be delivered later than was expected. Sellers are very reserved about making commitments, so that the market balance is maintained, prices being firm and unchanged in general. For small lots for prompt shipment premiums are greater in some lines.

Pig Iron.—Several merchant furnaces have blown out, on account of lack of coke, and prices would be considerably higher if there were any forced buying. There is much iron still due consumers. Bessemer remains quotable at $25, valley, with a sale last Friday of 200 tons, spot shipment, at this figure. Basic, recently at $24, valley, might not be obtainable again at the price, but is not in demand. Foundry is practically nominal at $24, valley. A sale of 100 tons of malleable is reported at $27.

Connellsville Coke.—Nearly all consumers have dropped out of the market. Foundries have made small purchases at $14@$14.50. Offerings are extremely light. Connellsville steam coal has sold up to $7.50.

Geography and Burma Mines, Limited

Review of Sundry Features of Recent Official Reports Dealing with the Operations of the Company in Upper Burma—Management Is Confronted with Problems That Are Unknown to Many American Engineers

By Arthur B. Parsons
Assistant Editor, *Engineering and Mining Journal-Press*

THE geography of a place, according to an opinion written by Noah Webster and concurred in by other authorities, involves more than the mere location of it on the surface of the Earth. Geography has to do with the disposition of rivers and mountains and forests and sea; with climatic conditions; with the distribution of natural resources; with the habits, the mode of life, and the activities of the human population. Bearing this in mind it is not unreasonable to say that geography is the most important element in the problem of the Burma Mines, Ltd. in the exploitation of the remarkable orebody at Bawdwin in Upper Burma. This observation is evoked by reading the technical report on the enterprise by E. P. Mathewson recently made public by the directors; and recalling also a report on the same subject, but of a quite different character, that appeared in April, 1920, over the signature of John A. Agnew.

A brief review of sundry features of these two reports will serve to explain how geographical conditions make necessary an entirely different procedure in mining and treating the ore than would be desirable and practicable if the mine were in Montana or Utah for example. Reference will also be made to the reports of the directors and of the Resident Manager, R. G. Hall for the year 1920; and, incidentally, some comment will be based on first hand information gained by me in "sojourning" a year at Namtu, where the mill and smelter are situated, and to which the ore is hauled 13 miles from the mines at Bawdwin.

One of the World's Largest High-Grade Orebodies

That the orebody is one of the largest known deposits of high-grade lead-silver-zinc ore is generally recognized. The reserve on Jan. 1, 1921, totalled 4,336,110 tons of "$86 ore" which in round numbers represents $375,000,000. In explanation of the use of the quotation marks I hasten to make clear that this is merely the gross value of the average metal content of the ore on the assumption that silver is worth 80c. per oz., and copper, zinc, and lead, respectively, 15, 8 and 7c. per pound. Whether these figures correspond closely with the probable price of the metals during the next ten or fifteen years is not material, nor does it matter particularly that I imitate the prospectus-writing promoter in appraising the ore at the value of the contained metal irrespective of the proportion of it that is economically recoverable. Ignoring zinc and copper, the ore averages 23.3 oz. silver per ton and 25.3 per cent lead; and, furthermore, the geographical and physical conditions are highly favorable for cheap mining. To date the equivalent of about $70,000,000 has been spent in the exploitation of the property, and although more than twelve years have elapsed since production was commenced, no dividend has ever been paid.

Modern Exploitation Begun in 1908

The attention of Europeans was first attracted by huge piles of rich lead "slag" from which the Chinese years ago had removed the silver. In 1908, a smelter was built at Mandalay and a narrow-gage railway was built from the mine at Bawdwin to the Lashio-Mandalay branch of the Burma Railways to haul the slag to the smelter. In 1911, the smelter was moved to Namtu, and a few years later, as the slag became exhausted, the plant began to operate on ore, which has been opened after diligent exploration of the old Chinese workings. Additions to the roasting plant at the smelter were made from time to time and during 1918-20 a concentrator was erected at Namtu to have a nominal capacity of 1,500 tons of ore per day.

First, I shall outline the elaborate plan proposed in the Agnew report, based in part on the recommendations of Lawrence Addicks who visited the property in 1918. It comprehended the mining of 1,500 tons of lead-silver-zinc ore per day in addition to 150 tons of copper-silver ore, for which latter, however, no detailed plan of metallurgical treatment was prescribed. Three alternative schemes of concentration were described, between which a choice had not been made definitely. These were (1) To treat average grade ore and to produce by selective flotation a lead concentrate, a zinc concentrate, and a middling. The zinc concentrate was to be shipped to Jamshedpur to a new retort smelter; the lead concentrate, with appreciable zinc content, was to be smelted at Namtu for lead and silver, after which the zincky slag and the mill middlings would be smelted in reverberatory furnaces for the recovery of lead and zinc as fume, and silver and copper as matte. (2) To make clean lead and zinc concentrates, for smelting in the usual manner, and a middling to be treated by a chemical process to yield lead bullion and further zinc-bearing product for retort smelting. (3) To produce only a clean lead concentrate and to treat the remainder chemically. This would have the advantage of producing a clean zinc product, a particularly desirable consideration from the standpoint of the zinc smelter.

The chemical process alluded to is a wet treatment either by the "Elmore" or by the "Double Chloride" method, both of which were said to have proved entirely successful in treating middlings from the Burma concentrator on a large experimental scale.

The new lead smelter for which excavations had been commenced adjoining the mill was planned to include two-stage roasting by Dwight-Lloyd machines, blast furnaces, bag-house, and lead and silver refineries with a capacity of 60,000 tons of lead and 5,000,000 oz. of silver annually. The existing smelter at Namtu was to be scrapped. This incidentally was contrary to the recommendations of Mr. Addicks.

Construction of Zinc Retort Smelter Started Near Calcutta

The construction of the zinc retort smelter and sulphuric acid plant at Jamshedpur had been commenced. This was to have a capacity of 25,000 tons of zinc concentrate annually and was to be operated by a subsidiary company in which the Burma Corporation was to hold at least 75 per cent of the capital. The site of the plant adjoined the huge Tata Steel Works which was expected to absorb a large part of the zinc output for galvanizing purposes.

Another project of which mention is made is a new railroad of one-meter gage to connect Namtu with the Burma Railway at Tahapali, and to replace the existing 2-ft. gage line now being operated between Namtu and Namyao, another point on the main line. The report stated that the Burma Railway was prepared to build this 46-mile line as soon as the consent of the Indian State Railways Department was obtained. It was proposed to improve the narrow-gage line between Bawdwin and Namtu and retain it for haulage between the mine and the mill.

Mr. Agnew then proceeded to calculate the profit to be expected from operations on the scale outlined using as a base the following prices for metals: Lead, £22 per long ton; zinc, £33 per long ton; copper, £80 per long ton; and silver, 40d. per oz.

The calculated per-ton profit with these prices varies from £3, if the "foul smelting" plan were to be followed, to £4.65, if it were decided to use the "chemical method" ex-

clusively for obtaining the zinc-bearing product to be shipped to Jamshedpur. Any increase in the market price of metals would, of course, be reflected in the profit per ton and the earning per share.

Mr. Agnew's plans were all right on paper. Although he may have been unduly optimistic as to the assured economic results to be obtained by use of the "chemical treatment" of the zinc-bearing products of the concentrator, his recommendations probably were quite sound insofar as the solution of the problem from a metallurgical standpoint was concerned. The trouble was that he and his advisors had neglected to study the geography of the northern Shan States. If the mine had been in the United States or in Europe such a program, with some modifications in the selection of metallurgical processes (as for instance the possible adoption of an electrolytic treatment for the recovery of the zinc), would have been entirely feasible. In Burma it was not only impracticable, but positively impossible of realization within the three-year period allowed for completing the necessary construction projects.

Plans Materially Modified in 1920

The annual report for 1920, published eight months after the Agnew report, says: "Ultimately, and particularly in view of existing financial conditions, your directors came to the conclusion that some material modifications were required in the policy of the company, based as it is on conditions different from those prevailing at the present time.

"They have decided, therefore, that the future policy to be adopted must be capable of being carried out by the company on its existing resources, which made it necessary:

"(a) To close up the construction of the zinc works in India, as financial considerations prevented the government of India contributing the anticipated loan, and the Tata Iron & Steel Co. desired to limit its participation.

"(b) To discontinue the erection of the new lead smelter and to rely upon the extension and improvement, at a much smaller cost, of the existing smelter.

"The present program now in operation is based on an annual output of 45,000 tons of refined lead and 4,500,000 oz. of silver, requiring a daily output of 700 tons of ore."

However, even if the Tata company and the government had not changed their attitude with respect to participating in the financial arrangements, and even if the markets for lead, zinc, and silver had not been, for the time being, much lower than had been hoped, intelligent engineering, I am quite certain, would have dictated the abandonment of the plan for the reason that I have mentioned—the peculiar geography of the country.

Mine Labor Is the Vital Element

In concluding his recent report, Mr. Mathewson says, "You can maintain a daily average production of 700 tons of ore from your Bawdwin mine *when you secure the necessary labor force at the mine.*" The italics are his and they state in a nutshell the first reason why the Agnew plan was impossible. Since it was impossible, there would be little use in discussing the other difficulties except for the fact that they reveal the unfavorable conditions under which operations are conducted in that part of the world.

So far as the physical condition of the mine is concerned, a production of 1,650 tons daily could be made; however, the average output for 1920 was only 339 tons per day. This does not mean that sufficient men to mine a greater tonnage could not have been obtained; they were not desired because the capacity of the smelting plant limited the production during 1920. In January, 1922, the mine output was 600 tons of ore daily, with 2,000 coolies engaged at Bawdwin and at Tiger Camp where is situated the portal of the main haulage adit from the mine; presumably, then, only 333 more coolies would be required to maintain production at the rate of 700 per day. Heretofore, however, the experience has always been that for each 100 men available in December, January, and February, there will be about half that number during the six-month rainy season from May to October.

To explain: the native inhabitants of the Northern Shan States and in Burmese territory within 400 miles of Namtu are almost useless as industrial laborers. They are not strong physically nor mentally, and they have no particular incentive to do other work than to cultivate their fields in a rather shiftless fashion, and they are utterly irresponsible. The only source of coolies that can be used underground to any advantage is Yunnan, the province of interior China that adjoins Burma. Many of these coolies come to Namtu in the latter months of autumn and work for a few months only to return to their homes before the wet season sets in. Heretofore, all efforts to persuade them to remain in Burma throughout the year have been fruitless. There are two reasons for this; first, they cannot stand the rains at Namtu and second, they must return home, covering a distance of 400 miles on foot, in order to cultivate their fields. It is said that the coolies must raise a crop each year in order to retain title to their land.

Colonization the Only Solution

One possible measure for improving the supply of mine labor is to colonize these Chinese in districts nearer to Namtu and Bawdwin although unfortunately there is little available agricultural land in the immediate neighborhood. Summing up his discussion of the labor question, Mr. Hall says: "It is to be considered, however, that without question the period from April or May to October or November will always be a period of diminished output, unsatisfactory work, and extreme anxiety to your staff. (Meaning the 125 "Europeans" who supervise the work.) It is unfortunate that at that time this locality is not exactly a health resort, and the period when your staff is called upon to make the greatest exertion is exactly the period when they are least able to stand it."

When it is remembered that the natives are only half civilized, that they speak a score of different languages, that the population is widely scattered, that they can live as they have always been accustomed to live, without troubling to work at the mines, and that most of them are naturally suspicious of Europeans, one can appreciate the practical impossibility of maintaining a production nearly five times as large as that of 1920, except after slow and tedious recruiting and colonizing that will require many years.

Transportation Is an Important Problem

But even if 1,650 tons of ore was mined the problem of transportation would present huge difficulties and here again the geography of the country is the disturbing element. The 13-mile line from Bawdwin to Namtu would have to carry the ore to the mill and the supplies to Bawdwin; the 33-mile line from Namtu to Namyao would have to carry fuel, fluxes, supplies, zinc concentrate and bullion, until such time as the proposed new line from Tahapali were completed—and railways are built very slowly indeed by the government in Burma. The preliminary survey for this proposed route was made in 1916 and further surveys were made subsequently. Three different resident managers have devoted their best efforts to getting something done, because a better road is vitally necessary. And yet Mr. Mathewson's report says "At present a reconnaissance survey is being run by your engineers along a proposed alternative route from Namyao to Namtu which looks promising and offers certain advantages over the proposed route from Tahapali." If there is one thing that the native dislikes more than anything else, it is to be hurried. I would not be surprised if the new survey is being made to please some official who desired a few years more to make up his mind whether to authorize the construction, and saw in the alternative route an excuse for further deliberation. This is only a guess, but at any rate it is clear that any program based on the assumption that the new road will be completed rests on a precarious foundation.

Six Months of Steady Rain

There is a vast difference between a railway in civilization and one in the tropical jungle; grades and curves must be contended with always, and land slides that block traffic completely may occur every day during six months in the year, when it rains almost incessantly and when cloudbursts are of frequent occurrence. Sometimes the ground is washed out under the ties (in Burma they call them sleep-

ers, a name that ought to be reserved for the native "worker") sometimes hundreds of tons of earth slide from the hill above and cover the tracks. In either event the result is the same—delay.

As indicating the slowness of transportation even under normal conditions, I may say that a person traveling by rail from Rangoon to Namtu is on the road three nights and part of four days, although the distance is less than 500 miles. Of the three nights two are spent waiting; beyond Mandalay the train doesn't travel at night and it doesn't go very fast when it is moving in the day time. The freight trains or "goods" trains make even slower time. Obviously it is necessary to transfer all freight at Namyao, the junction of the broad- and narrow-gage lines, and this is a source of added delay and expense. Likewise, of course, another transfer is necessary at Rangoon, from railway car to ship; and Rangoon itself is about as far by boat from either England or the west coast of the United States as it is possible to get.

Coke is obtained from Japan or India; in either case it must be shipped by boat to Rangoon and costs the equivalent of $25 per ton delivered at the smelter. The imports of timber, miscellaneous machinery, and warehouse supplies necessary to keep the property in operation on a basis of 700 tons of ore amount to some 60 tons per day. The lead bullion is heavy and runs up bills for haulage by land and water, and the transportation cost on the zinc concentrate that it was proposed to send to the plant at Jamshedpur would have been enormous. I mention these things simply to show the handicap under which isolation puts the property.

Three Years Required to Build Mill

The next point has to do with metallurgy; it shows how the characteristics of the inhabitants—another of the elements of geography—has an important bearing on the selection of the technical methods that will be most efficient. In his report for 1920 Mr. Hall remarks, "In July, actual concentration in one section of the mill was undertaken, or it would probably be more correct to say that at that time we managed to get the concentrating plant into a condition where we could begin training men to operate it." The completed plans for the concentrator and much of the machinery were at Namtu in September, 1917, and the concrete for the foundations was being poured by Christmas, 1917; and yet two years and a half elapsed before the first section of the gravity part of the plant was in such shape that it was possible to commence training the men! This is no reflection upon the management; rather it is a typical result of the delay that is unavoidable in the country. Many things, among them being the shortage of labor, combined to hinder the work. The first thing that an American learns, or at least ought to learn, is the futility of trying to revolutionize the ways of the country. The feeling prevails that what isn't done today may get done tomorrow, and if doomsday overtakes one in the meantime no harm has been done anyway. And this attitude persists in spite of the efforts of any outsider to change it. Its existence is a factor that must be taken into consideration in directing any industrial enterprise.

Natives Do Not Make Mill Men

Mr. Hall continues, "The operation of the concentrating plant requires considerable skill, not alone in the technical staff, but to a large extent in the labor itself. We have no industrial labor here to draw from, and consequently it was necessary to start one machine at a time and give the closest personal attention to the training of the man operating that machine.

"Only the gravity mill has been in operation, the flotation section not being completed up to the 1st of January (1921). The results given are not to be taken as indicative of the work to be expected of the mill."

Evidently these results were very bad, for the directors did not see fit to publish the statistics that Mr. Hall gave them, in the printed report to the shareholders. Only those who know how irresponsible and how stupid the Shan coolies are, can appreciate the difficulties that were experienced in trying to teach them to operate the concentrator. For one thing a coolie cannot be depended upon to do any thinking for himself, and the European foreman cannot well keep track of a hundred of them when their work is in any way complicated.

Another trouble is that there is never any assurance that a coolie who has been trained to perform a particular task with some degree of efficiency will report for work when he is expected. The excuse that he has a touch of malaria is always a valid one, for the malady comes and goes at a moment's notice. The result is that bad weather, or trouble in the plant, or some affair among the natives may result in an entire crew, especially at night, remaining away from work. The consequence can be imagined in the operation of a concentrator. Even when at work they assume no responsibility and exercise no initiative.

Simple and Established Processes Are Best

It is not difficult then to understand why, in advocating a simplification of the sequence of metallurgic operation, Mr. Mathewson says: "Further, Namtu is not the place to experiment with new processes, particularly chemical processes which require skilled European operators. To merit consideration at your hands a process should be an established one, simple in operation, requiring a minimum of European operators, and in addition should show profits sufficiently large to more than equal your possible profits, with the present process perfected, plus amortization of those portions of your plant that would become obsolete by its introduction. You must bear in mind also that it has taken years to train your staff and employees to their present duties and it would take a corresponding length of time to train them to operate a new process."

It would not be impossible to import enough competent men from Australia, for example, to operate any kind of a plant efficiently, but it would be too expensive. To get first-class men high wages would be required and traveling expenses to and from home would have to be paid. The turnover among these men would be high and to assure an adequate number of available men at all times a large excess would be required because of the prevalence of malaria. In spite of all measures to prevent it this disease will keep a considerable portion of the white force in the hospital at all times, and will be especially bad during the wet season. Experience has proven that the work must be done by coolies with as much supervision by white men as is practicable. Accordingly, the established processes have a great advantage when compared with new and novel ones.

Foul Smelting and a 700-Ton Mine Output Now Planned

The plan to be followed for the present is this: 700 tons of ore is to be mined; of the total about 40 per cent of the richest will be selected by a combination of belt picking and screening to go directly to the roasters at the smelter. This will average about 35-per cent lead. The remaining 420 tons will go to the concentrator to be increased in lead content before smelting. A new blast furnace, a new sinter-crushing plant, and a bag house will be added to the present smelter and the silver and lead refineries will be improved. Additional Dwight-Lloyd sintering machines will be installed. Essentially the smelter practice will remain the same, the furnace charge and the slag both being unusually high in zinc. No effort will be made to produce a clean lead concentrate, the purpose being merely to drop enough sphalerite and siliceous gangue minerals to increase the grade of the lead product. This will involve the minimum of careful and skillful attention in the mill. Flotation will not be used. Under existing conditions the zinc in the ore is of no value whatever and cannot be considered an asset.

I have no desire to paint a gloomy picture of the Burma enterprise; there is reason to believe that eventually it will more than return the capital invested. I feel safe in saying, however, that the job of the resident manager in Burma is about the most trying in the mining world today. The reason is not only the burdens of financial and engineering direction but in addition the continual worry attendant upon obtaining and managing a staff of "tempermental" Europeans—tempermental because they are far from home—and an army of Asiatics. This like most of his other troubles can be traced to geography.

MINING STOCKS

Week Ended July 22, 1922

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Ahmeek	Boston	63½	61	63¼	Sept. '20, Q	$0.50
Alaska-Br. Col. new.	N. Y. Curb	2⅜	2⅛	2⅛	.....	....
Allouez	Boston	25	25	25	Mar. '19	1.00
Anaconda	New York	54½	52⅝	53⅜	Nov. '20, Q	1.00
Arcadian Consol.	Boston	3⅜	3⅜	3⅜	.....	....
Ariz. Com'l.	Boston	9⅛	9	9	Oct. '18, Q	0.50
Big Ledge	N. Y. Curb	*13	*8	*8	.....	....
Bingham Mines	Boston	14½	14½	14½	Sept. '19, Q	0.25
Calumet & Arizona	Boston	61½	60	61	June '22, Q	0.50
Calumet & Hecla	Boston	280	270	275	June '20, Q	5.00
Canada Copper	N. Y. Curb	*30	*20	*20	.....	....
Centennial	Boston	11	9½	9½	Dec. '18, SA	1.00
Cerro de Pasco	New York	37⅜	36⅜	37⅜	Mar. '21, Q	0.50
Chile Copper	New York	22⅞	22⅛	22⅛	.....	....
Chino	New York	30⅜	29⅛	29⅛	Sept. '20, Q	0.37½
Columbus Rexall	Salt Lake	*31½	*31	*31	.....	....
Con. Arizona	N. Y. Curb	*3	*3	*3	Dec. '18, Q	0.05
Con. Copper Mines	N. Y. Curb	*51	*46	*50	.....	....
Copper Range	Boston	44½	43½	44	Mar. '22, Q	1.00
Crystal Copper	Boston Curb	1½	*81	1½	.....	....
Davis-Daly	Boston	7½	7	7½	Mar. '20, Q	0.25
East Butte	Boston	10⅝	10⅛	10⅛	Dec. '19, A	0.50
First National	Boston Curb	*65	*60	*65	Feb. '19, SA	0.15
Franklin	Boston	2⅜	2 1/16	2⅜	.....	....
Gadsden Copper	Boston Curb	83	83	83	.....	....
Granby Consol.	New York	31	29½	30⅛	May '19, Q	1.25
Greene-Cananea	New York	31½	30⅛	30⅛	Nov. '20, Q	0.50
Hancock	Boston	9½	2⅜	2⅜	.....	....
Howe Sound	N. Y. Curb	3⅛	2⅞	3⅛	Jan. '21, Q	0.05
Inspiration Consol.	New York	41⅞	40	41	Oct. '20, Q	1.00
Iron Cap	Boston Curb	7¼	7	7	Sept. '20, K	0.25
Isle Royale	Boston	24	24	24	Sept. '19, SA	0.50
Kennecott	New York	37¼	36	36⅜	Dec. '20, Q	0.50
Keweenaw	Boston	2¼	2⅛	2⅛	.....	....
Lake Copper	Boston	5	4½	5	.....	....
La Salle	Boston	1⅜	1⅜	1⅜	.....	....
Magma Copper	N. Y. Curb	28⅛	27½	28⅛	Jan. '19, Q	0.50
Majestic	Boston Curb	†*10	†*5	*10	.....	....
Mason Valley	Boston	2	1⅞	2	.....	....
Mass. Consolidated	Boston	3⅛	3	3⅛	Nov. '17, Q	1.00
Miami Copper	New York	30½	29⅜	29⅜	May '22 Q	0.50
Michigan	Boston	1⅛	1	1	.....	....
Mohawk	Boston	63	61½	62	July '22, Q	1.00
Mother Lode Coa.	N. Y. Curb	10¼	9⅜	10	June '22, I	0.50
Nevada Consol.	New York	17	16⅛	16⅞	Sept. '20, Q	0.25
New Cornelia	Boston	19⅞	18⅜	19⅛	May '22, K	0.25
North Butte	Boston	13¼	12⅛	12⅛	Oct. '18, Q	0.25
North Lake	Boston	...	...	⅛	.....	....
Ohio Copper	N. Y. Curb	*10	*9	*10	.....	....
Old Dominion	Boston	25	24¼	25	Dec. '18, Q	1.00
Osceola	Boston	33	33	33	June '20, Q	0.50
Phelps Dodge	Open Mar.	†175	†160	...	July. '22, Q	1.00
Quincy	Boston	46	43½	45	Mar. '20, Q	1.00
Ray Consolidated	New York	16⅞	16⅛	16⅛	Dec. '20, Q	0.25
Ray Hercules	N. Y. Curb	2	1⅝	2	.....	....
St. Mary's Min. Ld.	Boston	47	45½	47	Apr. '22, K	2.00
Seneca Copper	Boston	....	....	13½	.....	....
Shannon	Boston	*90	*85	*85	Nov. '17, Q	0.25
Shattuck Arizona	New York	9⅜	9⅛	9⅛	Jan. '20, Q	0.25
South Lake	Boston	1⅛	1⅛	1⅛	.....	....
Superior & Boston	Boston	1⅛	1⅛	1⅛	.....	....
Tenn. C. & C. cfs.	New York	10⅜	10⅜	10⅜	May '18, I	1.00
Tuolumne	Boston	*66	*63	*66	May '13,	0.10
United Verde Ex.	Boston Curb	27½	27½	27½	May '22, Q	0.25
Utah Consol.	Boston	3⅛	3⅛	3⅛	Sept. '18,	0.25
Utah Copper	New York	66⅛	64⅜	64⅜	June '22, Q	0.50
Utah Metal & T.	Boston	1 1/16	1 1/16	1 1/16	Dec. '17,	0.30
Victoria	Boston	1⅛	1⅛	1⅛	.....	....
Winona	Boston	1⅜	1⅛	1⅛	.....	....
Wolverine	Boston	†13	†11½	12	.....	....
NICKEL-COPPER						
Internat. Nickel	New York	18⅛	17½	17⅝	Mar. '19,	0.50
Internat. Nickel, pfd	New York	83½	83¼	83½	May. '22, Q	1.50
LEAD						
National Lead	New York	103½	100	100	June '22, Q	1.50
National Lead, pfd	New York	111⅝	111⅛	111⅛	June '22 Q.	1.75
St. Joseph Lead	New York	15⅛	14⅝	15	June'22, Q	0.25
QUICKSILVER						
New Idria	Boston	†*15	†*10	*10	.....	....
ZINC						
Am. Z. L. & S.	New York	18⅜	17	17⅛	May '20,	1.00
Am. Z. L. & S. pfd.	New York	45	43¾	45¾	Nov. '20, Q	1.50
Butte C. & Z.	New York	7	6½	7	June '18,	0.50
Butte & Superior	New York	30¾	28	29⅛	Sept. '20,	1.25
Callahan Zn-Ld	New York	8	7¼	7¼	Dec. '20, Q	0.50
New Jersey Zn.	N. Y. Curb	143	143	143	May '22, Q	2.00
Yellow Pine	Los Angeles	*60	*60	*60	Sept. '20, Q	0.03

Stock	Exch.	High	Low	Last		Last Div.
GOLD						
Alaska Gold	New York	⅛	⅛	⅛	.....	....
Alaska Juneau	New York	1⅜	1¼	1⅜	.....	....
Atlas	Toronto	*26½	*24	*24½	.....	....
Carson Hill	New York	†12	†10½	11	.....	....
Cresson Consol. G.	N. Y. Curb	2⅛	2 7/16	2⅛	July '22, Q,X	$0.10
Dome Mines	New York	30⅜	30⅛	30⅜	July '22, Q	.50
Florence Goldfield	N. Y. Curb	*13	*13	*13	.....	....
Golden Cycle	Colo. Springs	*84	*84	*84	June '21, Q	0.02
Goldfield Consol.	N. Y. Curb	*7	*6	*7	Dec. '19,	0.05
Gordon Murray	Toronto	*30	*28	*30	.....	....
Hollinger Consol.	Toronto	9.37	9.33	9.35	July '22,	0.05
Homestake Mining	New York	†71	†68½	70½	June '22, M	0.25
Keora	Toronto	*10	*8½	*9	.....	....
Kirkland Lake	Toronto	*44	*39	*41½	.....	....
Lake Shore	Toronto	2.35	2.26	2.30	Nov. '21, K	0.02
McIntyre-Porcupine	Toronto	16.60	16.00	16.40	May '22, K	0.05
Porcupine Crown	Toronto	*21½	*21	*21	July '17,	0.03
Porcupine V. N. T.	Toronto	*18½	*16	*17½	.....	....
Portland	Colo. Springs	*42	*37	*37	Oct. '20, Q	0.01
Schumacher	Toronto	*76	*74	*75	.....	....
Silver Pick	N. Y. Curb	*12	*10	*11	.....	....
Teck Hughes	Toronto	*60	*56	*59½	.....	....
Tom Reed	Los Angeles	*51	*50	*50	Dec. '19,	0.02
United Eastern	N. Y. Curb	1⅛	1 1/16	1 1/16	Apr. '22, Q	0.15
Vindicator Consol.	Colo. Springs	*4½	*4½	*4½	Jan. '20, Q	0.01
White Caps Mining	N. Y. Curb	*7	*7	*7	.....	....
Wright-Hargreaves	Toronto	2.66	2.55	2.65	July '22,	0.02½
Yukon Gold	N. Y. Curb	....	....	*95	June '18,	0.02½
SILVER						
Batopilas Mining	New York	1⅛	⅞	1⅛	Dec. '07, I	0.12½
Beaver Consol.	Toronto	*34	*31½	*33	May '20, K	0.03
Coniagas	Toronto	1.25	1.25	1.25	May '21, Q	0.12½
Crown Reserve	Toronto	*19	*17	*17½	Jan. '17,	0.05
Kerr Lake	N. Y. Curb	3⅜	3¼	3⅜	July '22, Q	0.12½
La Rose	Toronto	*3⅝	*30	*30¼	Apr. '22,	0.10
McKinley-Dar.-Sav.	Toronto	*25	*22	*25	Oct. '20, Q	0.03
Mining Corp. Can.	Toronto	1.05	1.00	1.05	Sept. '20, Q	0.12½
Nipissing	N. Y. Curb	5⅛	5¼	5⅛	July '22, Q,X	0.30
Ontario Silver	New York	7⅛	7⅛	7⅛	Jan. '19, Q	0.50
Ophir Silver	N. Y. Curb	....	....	*12	Jan. '12,	0.10
Temiskaming	Toronto	*25½	*24½	*24½	Jan. '20, K	0.04
Trethewey	Toronto	*4¼	*3	*4¼	Jan. '19,	0.05
GOLD AND SILVER						
Boston & Montana	N. Y. Curb	*17	*15	*15	.....	....
Cash Boy	N. Y. Curb	*7	*6	*7	.....	....
Dolores Esperanza	N. Y. Curb	2⅛	1⅞	2⅛	July '22,	2.50
El Salvador	N. Y. Curb	*6	*4	*6	.....	....
Jim Butler	N. Y. Curb	....	....	*4	Aug. '18, SA	0.07
Jumbo Extension	N. Y. Curb	*4	*3	*4	June '16,	0.05
MacNamara M.&M.	N. Y. Curb	*6	*6	*6	May '10,	0.02½
Tonopah Belmont	N. Y. Curb	1⅜	1⅛	1⅛	July '22, Q	0.05
Tonopah Divide	N. Y. Curb	*78	*75	*76	.....	....
Tonopah Extension	N. Y. Curb	1 1/16	1⅛	1 1/16	July '22, Q	0.05
Tonopah Mining	N. Y. Curb	1⅜	1⅜	1⅜	Apr. '22, SA, X	0.07½
West End Consol.	N. Y. Curb	1⅛	1 1/16	1⅛	June '22, SA	0.05
SILVER-LEAD						
Caledonia	N. Y. Curb	...	...	*8	Jan. '21, M	0.01
Cardiff M. & M.	Salt Lake	*81	*80	*80	Dec. '20,	0.15
Chief Consol.	Boston Curb	5⅛	4⅞	5⅛	May '22, Q	0.05
Consol. M. & S.	Montreal	25⅛	25⅛	25⅛	Oct. '20, Q	0.62½
Daly Mining	Salt Lake	†2.00	†1.50	...	July '20, Q	0.10
Daly-West	Boston	...	...	1⅜	Dec. '20, Q	0.25
Eagle & Blue Bell	Boston Curb	†3	†2½	2⅜	Apr. '21, K	0.05
Electric Point	Spokane	*5	*5	*5	May '20, SA	0.03
Federal M. & S.	New York	†13	†12⅛	11½	Jan. '09,	1.50
Federal M. & S. pfd.	New York	51⅜	50	51⅜	June '22, Q	1.25
Florence Silver	Spokane	*33	*25	*33	Apr. '19,	0.01½
Grand Central	Salt Lake	†*65	†*60	*61	Jan. '21, K	0.01
Hecla Mining	N. Y. Curb	6¼	6¼	6¼	June '22, Q	0.15
Iron Blossom Con.	N. Y. Curb	31	30	*31	Apr. '22, Q	0.02½
Judge M. & S.	Salt Lake	†2.60	†2.40	2.50	Sept. '20, Q	0.12½
Marsh Mines	N. Y. Curb	*16	*15	*16	June '21, I	0.02
Prince Consol.	Salt Lake	*7⅛	*6⅛	*7⅛	Nov. '17,	0.02½
Rambler-Cariboo	Spokane	*5	*5	*5	Feb. '19,	0.01
Rex Consol.	N. Y. Curb	*8	*8	*8	.....	....
Standard Silver-Ld.	N. Y. Curb	*19	*19	*19	Oct. '17,	0.05
Stewart Mines	N. Y. Curb	*8	*6	*8	Dec. '15,	0.05
Tamarack-Custer	Spokane	3.45	3.40	3.40	Jan. '21, K	0.04
Tintic Standard	Salt Lake	1.97½	1.95	1.95	Dec. '21, Q	0.05
Utah Apex	Boston	2⅛	2⅛	2⅛	Nov. '20, K	0.25
Wilbert Mining	N. Y. Curb	*15	*9	*9	Nov. '17,	0.01
VANADIUM						
Vanadium Corp.	New York	50⅛	46½	47½	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	...	...	67	July '22, Q	1.50
Asbestos Corp. pfd.	Montreal	...	...	88	July '22, Q	1.75
SULPHUR						
Freeport, Texas	New York	23⅛	22⅛	22⅛	Nov. '19, Q	1.00
Texas Gulf	New York	48⅛	47½	47⅝	June '22, QX	1.00
MINING, SMELTING AND REFINING						
Amer. Sm. & Ref.	New York	62⅞	60⅞	61⅛	Mar. '21, Q	1.00
Amer. Sm.& Ref. pf.	New York	98¼	98	98	June '22 Q	1.75
Am. Sm. Sec. pf. A	New York	†95	†93	93	July '22, Q	1.50
U. S. Sm. R. & M.	New York	41⅛	41	41	Jan. '21, Q	0.50
U.S. Sm.R.& M. pf.	New York	†50	†47	47	July '22, Q	.87½

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Oil; Colorado Springs, The Financial Press, N. Y.

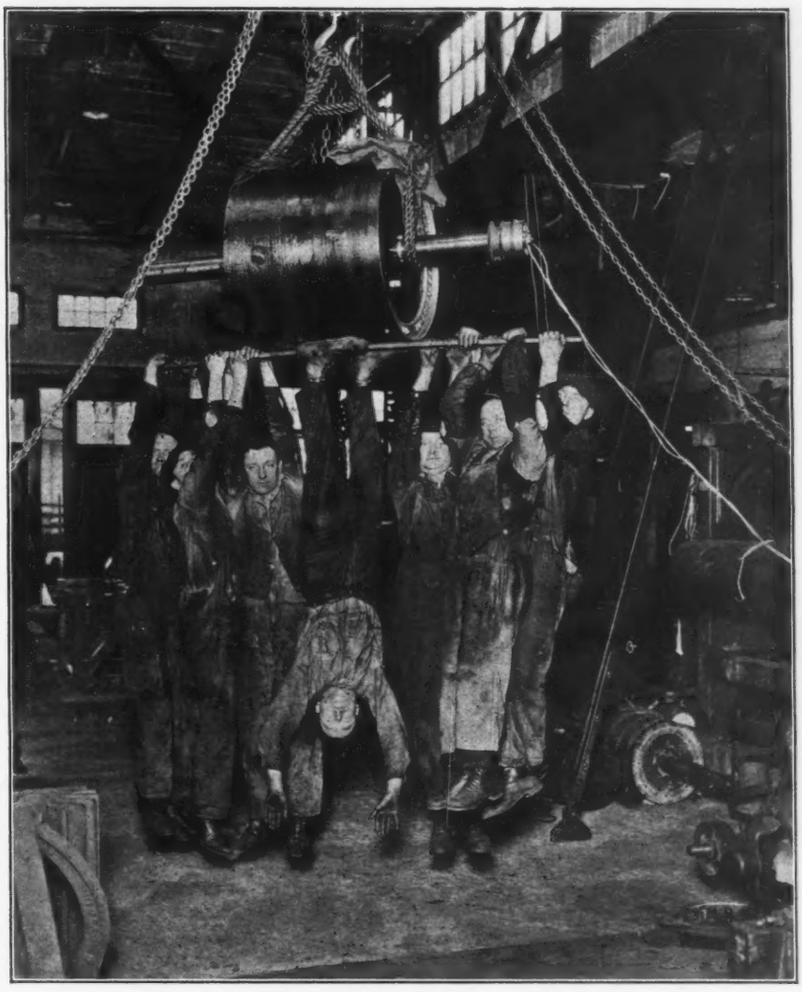
NEW MACHINERY AND INVENTIONS

What Is the Strength of a Magnetic Pulley

The accompanying illustration of a "stunt" that took place in the plant of the Dings Magnetic Separator Co., Milwaukee, Wis., shows, in an excellent manner, the strength of a magnetic pulley.

The only support of the man hanging head downward is the attraction of the pulley for the iron in his shoes. The area of the iron bar in contact with the pulley is small, yet the total weight of the six men suspended is about 1,000 lb.

The Dings company states that a pulley must possess the great magnetic power that this test demonstrates in order to be effective at all times in removing iron from conveyed material. The necessity for this is explained by the fact that in attracting fine particles of tramp iron through a heavy load of conveyed material a magnetic force sufficient to directly support an enormous load is required.



Suspending 1,000 lb. with a magnetic pulley

A New Bleeder-Type Turbine

Increasing competition demands lower manufacturing and operating costs, and better steam economy in every industrial plant. Heretofore, especial study has centralized upon the large power installations and the smaller plant has not made the same progress toward economical operation that has been perfected in the plant many times larger.

With a desire to decrease operating costs in the average size industrial power plant, the Moore bleeder type turbine, manufactured by the Moore Steam Turbine Corporation, Wellsville, N. Y., has been perfected and placed upon the market. It fulfils a long felt want wherever steam, after generating power, is used for heating buildings, heating feed water for boilers, manufacturing and cooking. It solves in a satisfactory manner the problem of heat balance and acts as a reducing valve for converting high pressure steam to a lower desired pressure, meanwhile extracting the energy due to the heat drop.

It is stated that this turbine is simple in design, easy to "get at" and automatically regulates perfectly, either for varying power conditions or fluctuating demands for exhaust steam. The efficiencies obtained have proven exceedingly gratifying. One operator, for instance, who had bought outside power at $600 per month, yet who had generated steam in his boilers at 125 lb. per sq. in. and reduced it to 40 lb. per sq. in. through a reducing valve, for cooking purposes, found that a Moore bleeder turbine could take the place of the reducing valve, generate his power requirements and fulfil his demand for exhaust steam. He saved $600 per month, which in less than a year paid for the turbo-generator.

The general design of the Moore bleeder type is that of a multi-stage turbine, with one or two velocity stages followed by a number of pressure stages. Between the velocity stage and pressure stage is the bleeder chamber which connects to the heating or cooking system. The cylindrical bleeder valve allows excess steam to enter the chamber from which point it flows through the pressure wheels to the condenser.

An oil relay governor controls the turbine speed. A cylindrical bleeder valve controls the steam flow rate to the bleeder exhaust.

Since the bleeder type serves as a combination non-condensing high-pressure condensing turbine, it effects a close heat balance, even where there are only one or two main units. The flow of steam to a heating system being determined by the pressure of that system, the load to be carried by the high- and low-pressure elements, in order to result in the proper heat balance, is automatically determined by the cylindrical bleeder valve which regulates the flow of low-pressure steam to the heating system. The oil relay governor automatically regulates the flow of high-pressure steam to the high pressure stages to meet changing load conditions. Hence with these two simple and positive equalizers a perfect balance is automatically maintained.

Among the claims for the Moore bleeder turbine, with its cylindrical valve, may be mentioned the following:

The cylindrical type of valve gives a wide unobstructed opening with minimum pressure drop.

The weight of the valve, together with the thrust due to steam pressure, is carried on two large bearings, one at either end. Very little effort is required to turn the valve.

The bleeder valve clearance is greater than the end bearing clearances. This not only makes for easy rotation of the valve but likewise allows a small quantity of high-pressure steam to leak past the valve into the low-pressure stage. This prevents high temperatures which would occur due to windage friction of the rotating elements in the surrounding thinned-out steam.

The entire bleeder valve can be quickly moved without disturbing or dismantling the casing.

The valve forms part of the turbine casing thereby presenting a compact appearance.

The valve arrangement has only a few parts and requires little attention.

The Moore bleeder turbine is built for initial pressures as low as 100 lb. per sq.in. and bleeder pressure as high as 40 lb. per sq. in.

Eleventh Safety Congress to Include Safety Exhibits

The safety exhibit to be held at the Eleventh Annual Safety Congress of the National Safety Council, Detroit, Mich., will represent the advance made to date in developing safety devices and equipment. Practically all of the leading manufacturers of safety devices and equipment will have booth space in the gymnasium on the first floor of the Cass Technical High School. The exhibit will be opened at 9 o'clock Monday morning, August 28, and will be open thereafter between the hours of 9 a. m. and 6:30 p. m. daily. The exhibit will close Sept 1. A partial list of the exhibitors is as follows:

American Abrasive Metals Co., 50 Church St., New York City.

Bradley Wash Fountain Co., 1180 Old Colony Bldg., Chicago, Ill.

Clipper Belt Lacer Co., Grand Rapids, Mich.

The Dayton Safety Ladder Co., Miamisburg, Ohio.

V. V. Fittings Co., 711 Cherry St., Philadelphia, Pa.

F. A. Hardy & Co., 10 S. Wabash Ave., Chicago, Ill.

Improved Aluminum Gasco Protector Co., Chicago, Ill.

Julius King Optical Co., 12 Maiden Lane, New York City.

Lungmotor Co., 711 Boylston St., Boston, Mass.

Macbeth-Evans Glass Co., Pittsburgh.

Michigan Mutual Liability Co., Real Estate Exchange Bldg., Detroit, Mich.

Mine Safety Appliances Co., 908-912 Chamber of Commerce Bldg., Pittsburgh, Pa.

Mutual Electric & Machine Co., 858 W. Fort St., Detroit, Mich.

Ocean Accident & Guarantee Corporation, 114 Fifth Ave., New York City.

Protecto Safety Appliance Co., 50-58 Columbia St., Newark, N. J.

Prudential Insurance Company of America, Newark, N. J.

Pyrene Mfg. Co., 520 Belmont Ave., Newark, N. J.

The Safety Equipment Service Co., 1104 Hamilton Ave., N. E., Cleveland.

Safety First Supply Co., Bullitt Bldg., Philadelphia, Pa.

Safety Overall & Apron Co., 1006 Finance Bldg., Philadelphia, Pa.

Square D. Company, Detroit, Mich.

Standard Safety Equipment Co., 168 N. Michigan Ave., Chicago, Ill.

Stonehouse Signs, Inc., 842 Larimer St., Denver, Colo.

Trumbull Electric Co., Woodford Ave., Plainville, Conn.

Westinghouse Electric & Mfg. Co., 1535 Sixth St., Detroit, Mich.

TRADE CATALOGS

Heating and Power Plant—McAlear Manufacturing Co., 1901 S. Western Ave., Chicago, Ill., have ready for distribution a new 128-p. catalogue, known as No. 27, which illustrates many new devices, including an individual temperature-control valve, specialties for all power plants, vacuum and vapor heating systems, oil refining and water works plants, plumbing systems and marine service, together with illustrations showing their application and use. The individual temperature-control valve is self-contained and can be applied to any radiator, old or new, without additional piping other than the supply and return. When the thermostatic member is set for the desired room temperature, it automatically controls the opening and closing of the valve.

Drag Scrapers—Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill., have recently issued Book 444, which contains information and illustrations on the new Link-Belt power hoe which has been patented by this company. It is claimed that this drag scraper is not a substitute for all other types of elevating, conveying, unloading, reloading, storing and reclaiming equipment. The advantages offered are that the device is applicable to large or irregular-shaped storage that cannot be served by other types of equipment, as well as to small and regular-shaped areas; it is suitable for storing either in buildings or out of doors; it is furnished in sizes to meet any required storage area and capacity, and does not require a skilled operator. The various parts are such that it is impossible for them to be seriously damaged through misuse which such equipment usually receives.

Diamond Drills—Sullivan Machinery Co., Chicago, Ill., have recently issued Bulletin 69-O, "Diamond Drilling for Oil." The advantages of the diamond drill for different kinds of oil boring work have been thoroughly demonstrated as there have been and are a number of such machines in successful operation. In the *Journal-Press* of July 22 appears an article, "Diamond Drilling for Petroleum," by Ernest R. Lilley. Dr. Lilley says, among other statements, "The oil man finds four points of interest in his investigation of the possible extension of the use of the diamond drill in oil field work, namely, its utilization for: (1) Prospecting structure; (2) deepening old wells and partly completed wells; (3) wildcat drilling; and (4) production drilling." The bulletin describes the advantages and methods employed in boring for oil with the Sullivan diamond core drills, and gives details of the drills themselves and the equipment used with them.

CONSTRUCTION NEWS

Nevada Consolidated Will Re-build Immediately at McGill

Immediate re-construction of the burned plant of the Nevada Consolidated Copper Co. at McGill, Nev., is announced. The work of cleaning up the site has already been commenced with three shifts of men working.

Copper Range Co. Plans New Construction at Trimountain

A new steel "rockhouse" will be built at No. 2 shaft, Trimountain, one of the Copper Range mines in the Michigan Copper Country. It will be modern in every respect and capable of handling an increased tonnage. No. 2 has showed a decided improvement in the last year, the openings on the lower levels being richer than above.

Two New Milling Plants in Northern Ontario

The Ribble Mines, Ltd., in the West Shining Tree district of Ontario, is planning the erection of a 100-ton mill, and a 250-hp. hydro-electric plant. The company's post office address is Westree, Ontario.

The Clifton-Porcupine Mines, South Porcupine, will build a small stamp mill.

Plant for Grinding China Clay Will Be Erected at Caliente, Nev.

The American Clay Co. will shortly equip its china clay mine near Caliente, Nev., with a crushing and grinding mill. W. R. Boggs, consulting engineer, has recommended the addition of new equipment.

Prince Consolidated, of Pioche, Nev., Plans New Power Plant

The Prince Consolidated Mining Co. will shortly require equipment for its power plant at the Prince mine at Pioche, Nev. Murray C. Godbe, manager, has his office in the Newhouse Building, at Salt Lake City, Utah.

Kanok Metal Co. Uses Sheet Zinc on New Mill Building

The Kanok Metal Co. is erecting a new concentrator to take the place of the one known as the McBee, near Crestline, Kan., which was burned down several months ago. The roofing being used on the new plant is corrugated sheet zinc; A. M. Gaines, the manager, believes the excess cost of this material over corrugated galvanized sheets is so small that it will be much more than balanced by the greater salvage value.